Georgia Tech College of Computing

CS 3251- Computer Networks 1:

Midterm Review

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Lecture 17

10/17/2013

The State of Ohio

Mandate

- "*The art of war teaches us to rely not on the likelihood of the enemy's coming, but on our own readiness to receive him; not rely on the chance of his not coming, but rather on the fact that we have made our position unassailable.*"

-- Sun Tzu, The Art of War

Announcements

- The midterm will be given during our next class.
  - We will spend today reviewing, but this exercise alone will not be enough for you to pass the test.
  - Danger Will Robinson! You will need to study!

Last Time(s)

- We have covered a huge amount of material thus far:
  - 486 Pages of Textbook reading
  - 1 Academic Paper (10 pages)
  - Side conversations, diversions, student questions, homework questions...
- All these things are fair game.
  - You are expected to be well versed in the topics we have covered thus far....

Rules

- The test starts precisely at 9:35 and ends at 10:55.
  - If you show up late, *you do not get extra time.*
- Cell phones are banned.
  - I will keep a clock going in the front for you to see.
  - Too many people cheat, so nobody can have these out.
  - If I see a phone, *I will take your exam.*
- Calculators allowed, but must be independent
- Write all answers on the test itself!

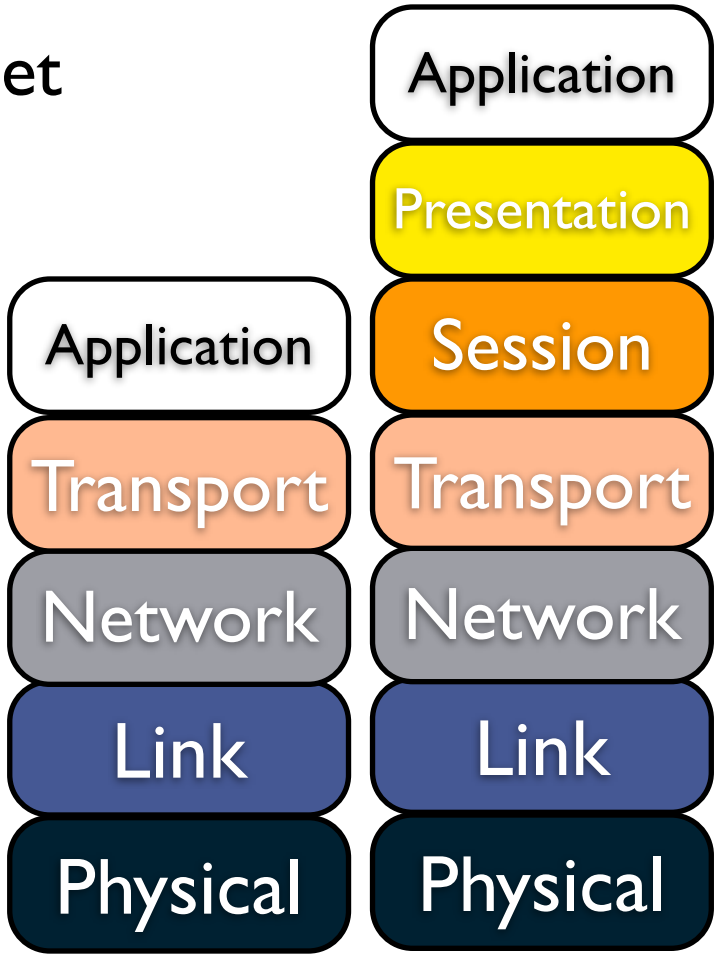

RULES & ORDERS
TO BE OBSERVED BY
The Poor of the Parish Workhouse of Aylesbury,
IN THE COUNTY OF BUCKS.

Format

- Short Questions
  - Should be easy to answer. 2-3 sentences MAX.
  - If you write more, you've missed the point.
- Regular Questions
  - Multiple parts, each one requiring more in-depth answers.
  - May require math, applying an algorithm, being creative.

OSI vs Internet

- What are the layers of the OSI protocol stack?
- What are the layers of the Internet protocol stack?
- Why are they different?



Application-Layer Protocols

- What is DNS?
  - How does DNS work?
  - How is DNS made scalable?
  - Are there any security issues?
- SMTP uses 7-bit ASCII. How are other character sets possible (e.g., chinese)?
- Is HTTP a stateful or stateless protocol?

Data Transmission

- Two hosts are directly connected by a single 2 Mbps link. How long does it take to send a 1 MB (assume 10^6) file?

$$L/R = File\ Length/Link\ Rate$$

- 1MB file = 1,000,000 bytes = $8*10^6$ bits
- 2 Mbps link
- $$\frac{8 \times 10^6\ bits}{2\ Mbps} = 4\ seconds$$

Utilization

- Assume that the link has an MSS of 100 bytes and that we are using a stop and wait protocol. If we have no packet loss and an RTT of 100ms, what is the utilization of this link?

$$\frac{L/R}{RTT + L/R}$$

- L/R = $\frac{100 \times 8\ bits}{2 \times 10^6\ bits/sec} = 0.0004\ sec = 0.4\ ms$

- Making utilization: $\frac{0.4\ ms}{100\ ms + 0.04\ ms} = 0.0004\ sec = 0.4\%$
- What would utilization be if we pipelined (i.e., had a larger window size)?

HTTP

- What is the difference between HTTP 1.0 and 1.1?
  - Assume RTT of 10ms...
- If your browser visits a webpage and sees 5 referenced objects (assuming they are negligible in size), how long does it take to retrieve all objects using HTTP 1.0?
  - $2 \times RTT + 5 \times 2 \times RTT = 12RTT = 120\ ms$
- How long does it take if you use HTTP 1.1 with pipelining?
  - $2 \times RTT + 1 \times RTT = 3RTT = 30\ ms$

Checksumming

- Calculate the Internet Checksum for this packet:

  01100100 01001001
  01110010 11001001

- Sum: 11010111 000100010

- 1's compliment: 00101000 111011101

- How are 1s and 2s compliment different? Why do we do 1's compliment after summing?

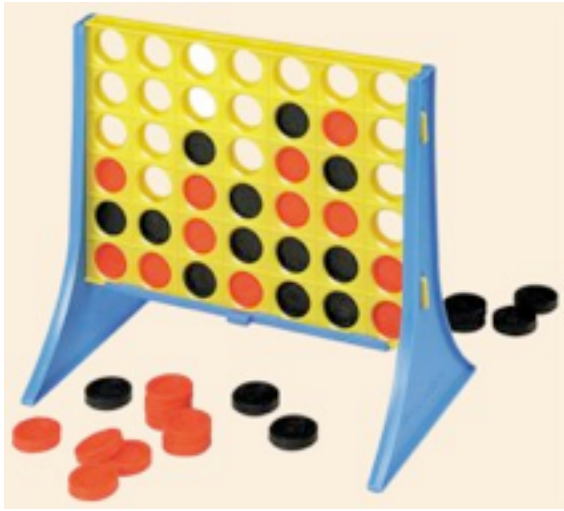
TCP vs UDP

- How is multiplexing/demultiplexing different for TCP and UDP?
- How does UDP violate the fairness instituted by TCP?
- What is Additive Increase, Multiplicitive Decrease (AIMD)?
  - What is slow start? Fast retransmit?
- How are the headers of TCP and UDP packets different?

Connections

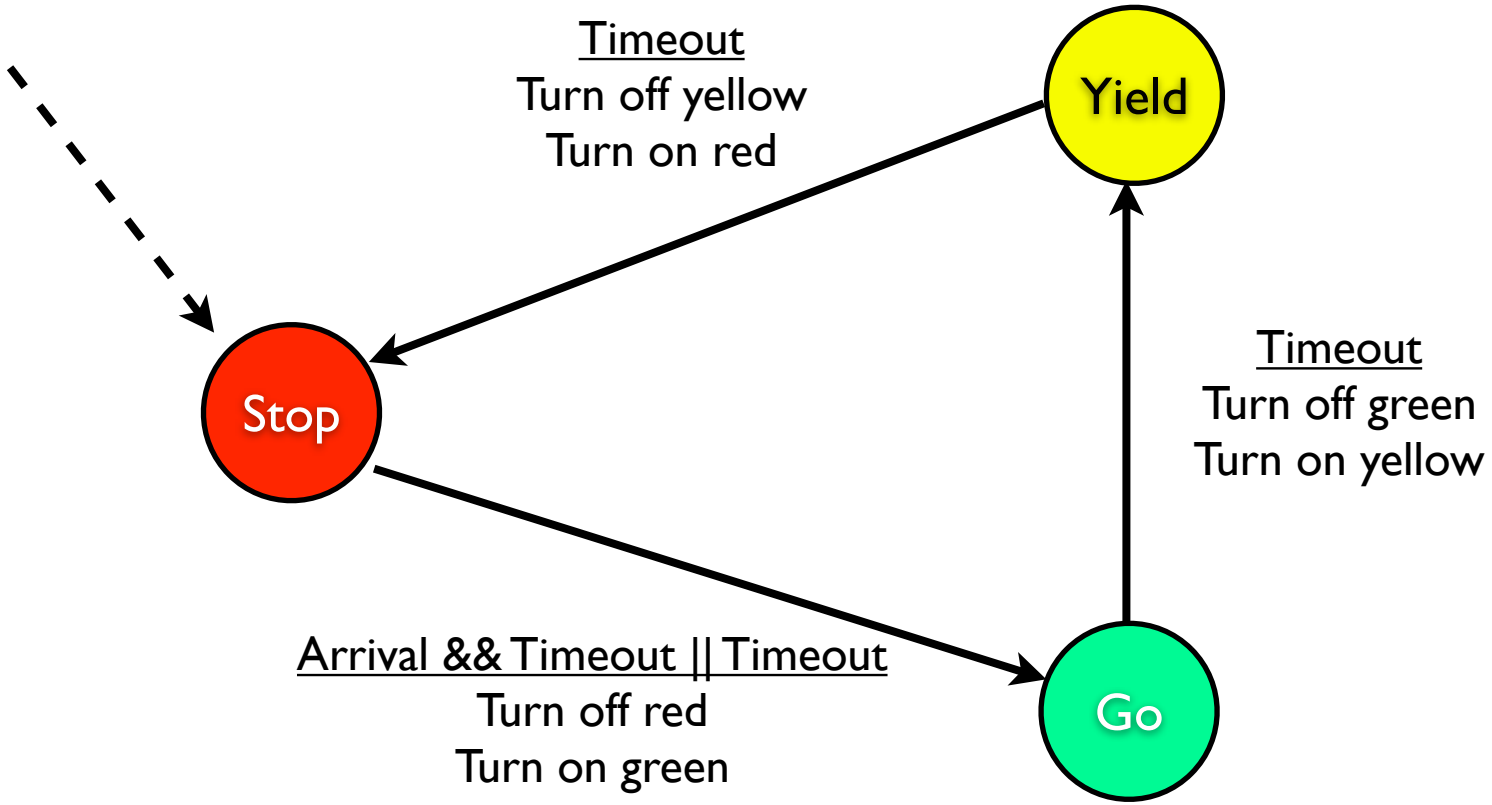
- How are circuit switched and packet switched networks different?
  - What are the advantages and disadvantages of each?

- How are TDMA and FDMA different?
  - What are the advantages and disadvantages of each?



Finite State Machines

- Design a finite state machine for a stoplight:



A Link-State Routing Algorithm

Dijkstra's algorithm

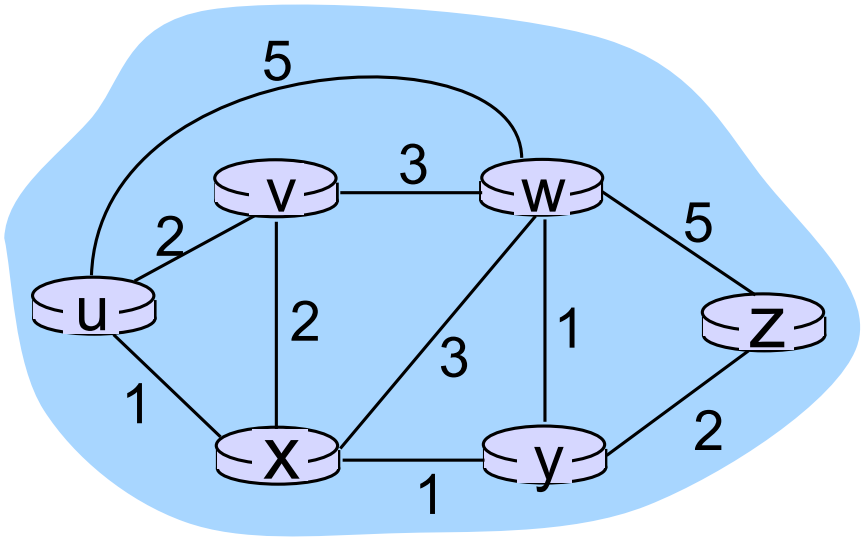
- net topology, link costs known to all nodes
  - accomplished via "link state broadcast"
  - all nodes have same info
- computes least cost paths from one node ('source") to all other nodes
  - gives forwarding table for that node
- iterative: after k iterations, know least cost path to k dest.'s

Notation:

- c(x,y): link cost from node x to y; = ∞ if not direct neighbors
- D(v): current value of cost of path from source to dest. v
- p(v): predecessor node along path from source to v
- N': set of nodes whose least cost path definitively known

Dijkstra's algorithm: example

Step	N'	D(v),p(v)	D(w),p(w)	D(x),p(x)	D(y),p(y)	D(z),p(z)
0	u	2,u	5,u	1,u	∞	∞
1						
2						
3						
4						
5						



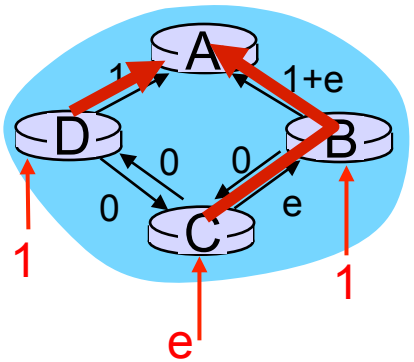
Dijkstra's algorithm, discussion

Algorithm complexity: n nodes

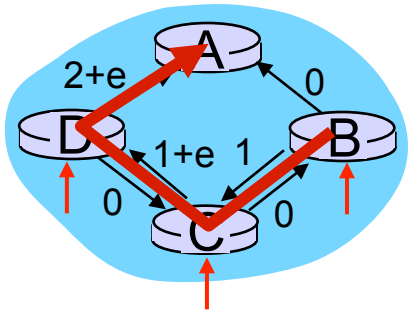
- each iteration: need to check all nodes, w, not in N
- $n(n+1)/2$ comparisons: $O(n^2)$
- more efficient implementations possible: O(nlogn)

Oscillations possible:

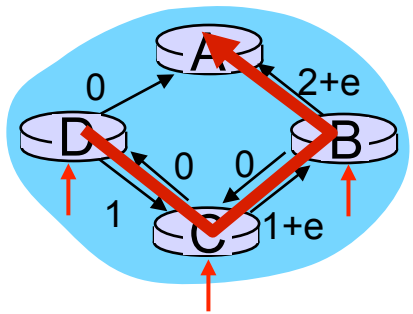
- e.g., link cost = amount of carried traffic



initially



given these costs, find new routing…. resulting in new costs



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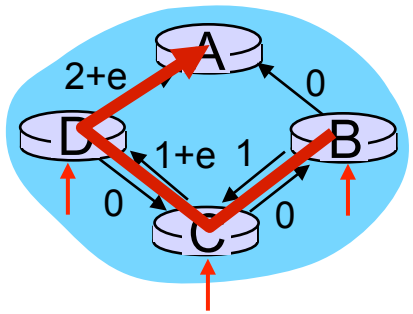

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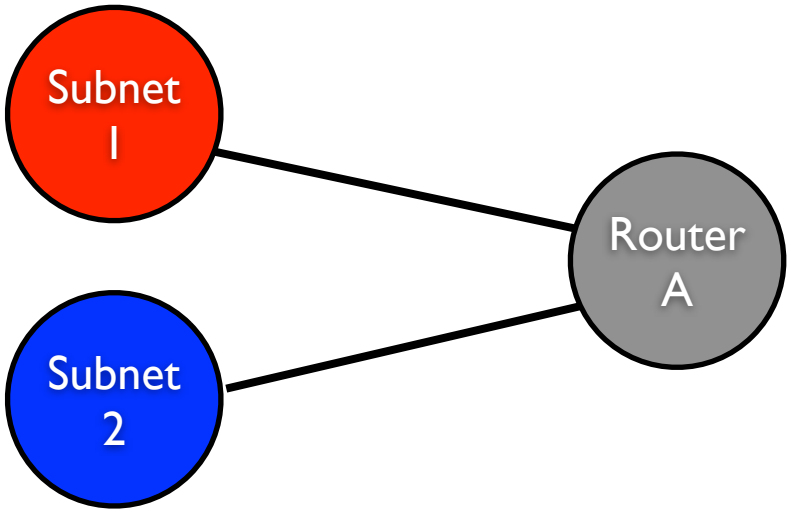
Routing

- Which routing algorithm does RIP use? OSPF?
- What two techniques does OSPF use to make it scalable for large domains?
- What is THE inter-AS routing protocol?
  - Are there any security issues with this protocol?

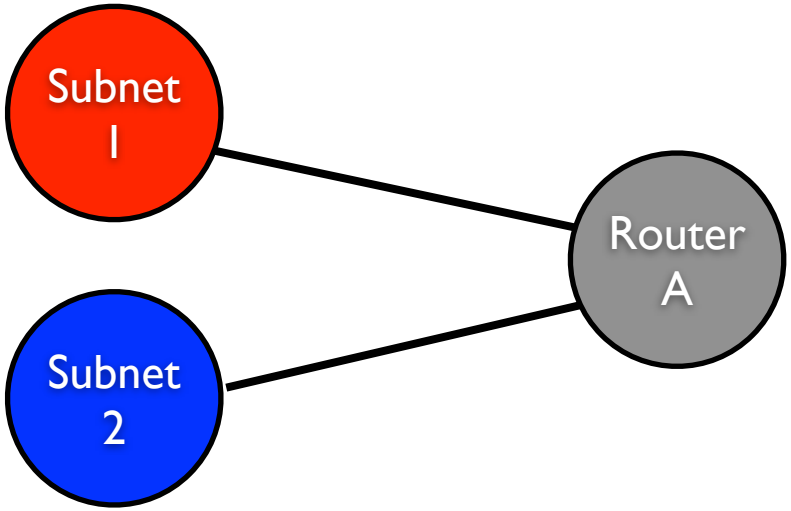
Subnets



- Router A is assigned the range 130.207.8.0/21 and wants to divide this space between two subnets.

- What is the third octet in binary?
  - 130.207.“00001000”
  - Splitting this in half means specifying the next bit...

Subnets



- Subnet A: 8+0 = 130.207.8.0/22
- Subnet B: 8+4 = 130.207.12.0/22

Access Protocols and Techonolgies

- Why is slotted ALOHA more efficient than ALOHA?
- How many bit errors can a two-dimensional error correcting scheme fix? Detect?
- If ECCs can't detect everything, why do we use them at all?

Wrap-up

- This exam will likely take you the entire class period.
  - Study hard - give yourself time to review your answers.
- This exam will be *tough*, but *fair*.
- Good luck!