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GENI in the classroom: Course Modules for Teaching Networking Concepts

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Goals for this Project

- Curriculum modules for teaching core networking concepts in an undergraduate networking class
- Modules based on concepts from two widely used textbooks (Kurose and Ross, Tanenbaum and Wetherall)
- Example topics: socket programming, TCP congestion control, traffic generation, IP routing and forwarding, network security
- **Modules available from the GENI wiki**



Request – Survey Participation

- Derek's thesis: Survey request
- Sheet going around...
- We thank you for including your name and contact

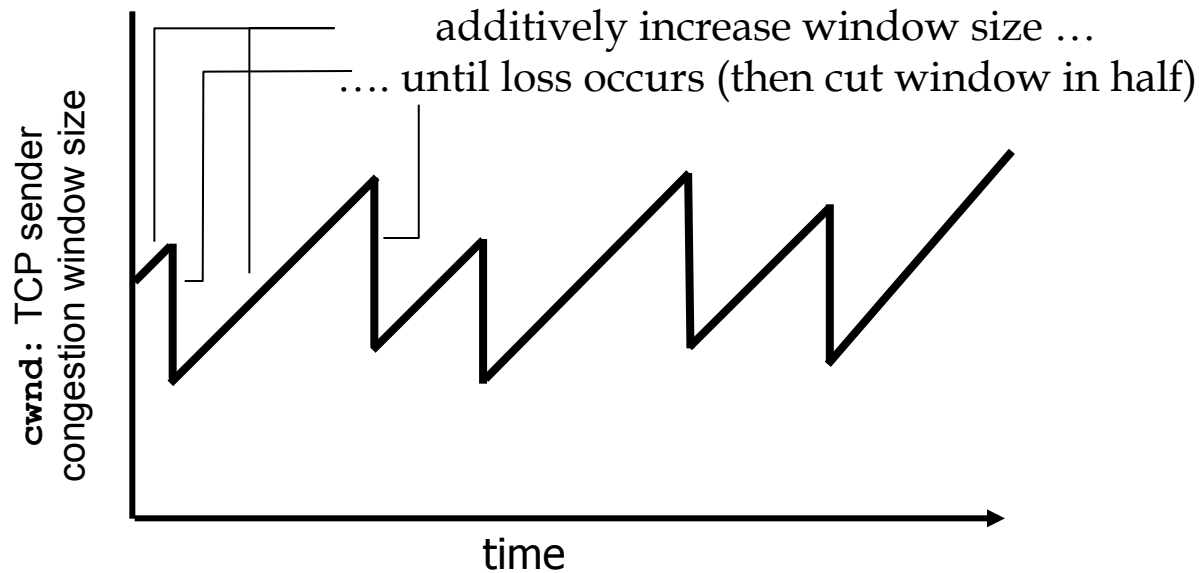


Two kinds of Modules

- **In-class Demo Modules:**
Teaching Concepts Through
Demonstration
- **Assignment Modules:** Learning
Through Experimentation



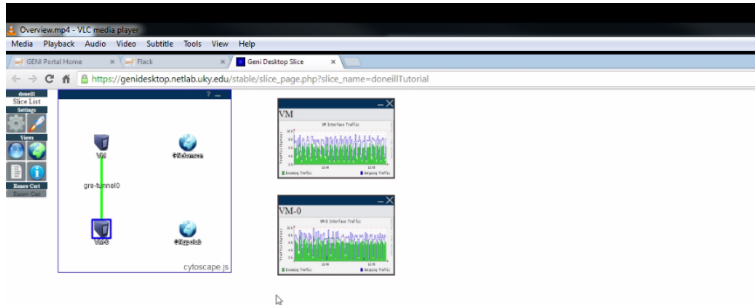
Example: Demo Modules



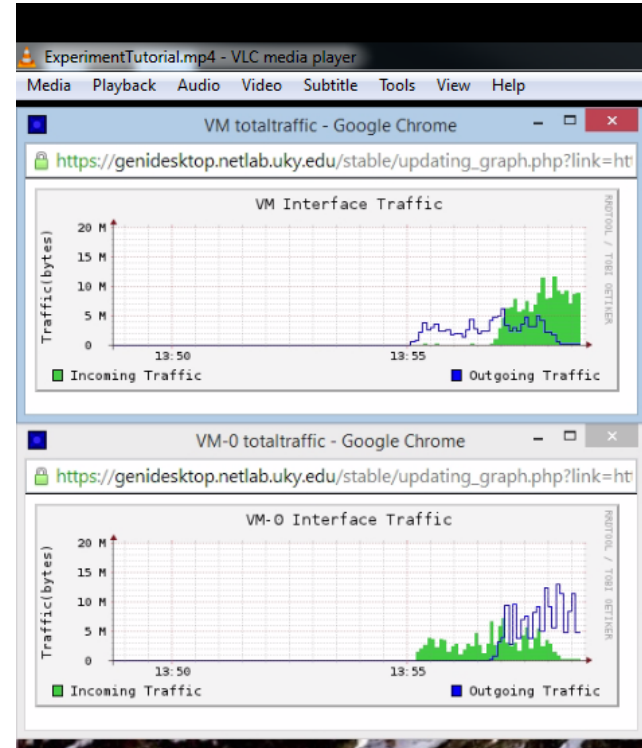
TCP congestion control: AIMD
(Additive Increase Multiplicative Decrease)



Example: Demo Modules



```
[root@VM done11]# iperf -s &
[1] 2457
[root@VM done11]# bind failed: Address already in use
Server listening on TCP port 5001
TCP window size: 83.5 Mbyte (default)
-----
[root@VM done11]# iperf -c 192.168.1.1 -t 180 -i 10
Client connecting to 192.168.1.1, TCP port 5001
TCP window size: 16.0 Kbyte (default)
-----
[1] local 192.168.1.2 port 45699 connected with 192.168.1.1 port 5001
10) interval: Transfer Bandwidth
3) 0-10.0 sec 13.2 Mbytes 11.1 Mbits/sec
3) 10-20.0 sec 11.1 Mbytes 26.1 Mbits/sec
3) 20-30.0 sec 78.1 Mbytes 23.6 Mbits/sec
3) 30-40.0 sec 26.0 Mbytes 21.8 Mbits/sec
3) 40-50.0 sec 19.8 Mbytes 16.6 Mbits/sec
3) 50-60.0 sec 18.4 Mbytes 13.4 Mbits/sec
3) 60-70.0 sec 16.0 Mbytes 13.4 Mbits/sec
3) 70-80.0 sec 34.8 Mbytes 29.2 Mbits/sec
3) 80-90.0 sec 19.9 Mbytes 16.7 Mbits/sec
3) 90-100.0 sec 33.9 Mbytes 28.4 Mbits/sec
3) 100-110.0 sec 44.4 Mbytes 37.2 Mbits/sec
3) 110-120.0 sec 44.4 Mbytes 37.2 Mbits/sec
3) 120-130.0 sec 23.1 Mbytes 17.7 Mbits/sec
3) 130-140.0 sec 27.6 Mbytes 23.2 Mbits/sec
3) 140-150.0 sec 36.4 Mbytes 30.3 Mbits/sec
3) 150-160.0 sec 33.0 Mbytes 27.7 Mbits/sec
3) 160-170.0 sec 29.1 Mbytes 24.4 Mbits/sec
3) 170-180.0 sec 19.4 Mbytes 16.3 Mbits/sec
3) 0-180.2 sec 497 Mbytes 23.1 Mbits/sec
[root@VM done11]#
```



Play the overview video



Example: Assignment Modules

Assignment: Effect of TCP receiver window size and Round Trip Time (RTT) on TCP throughput

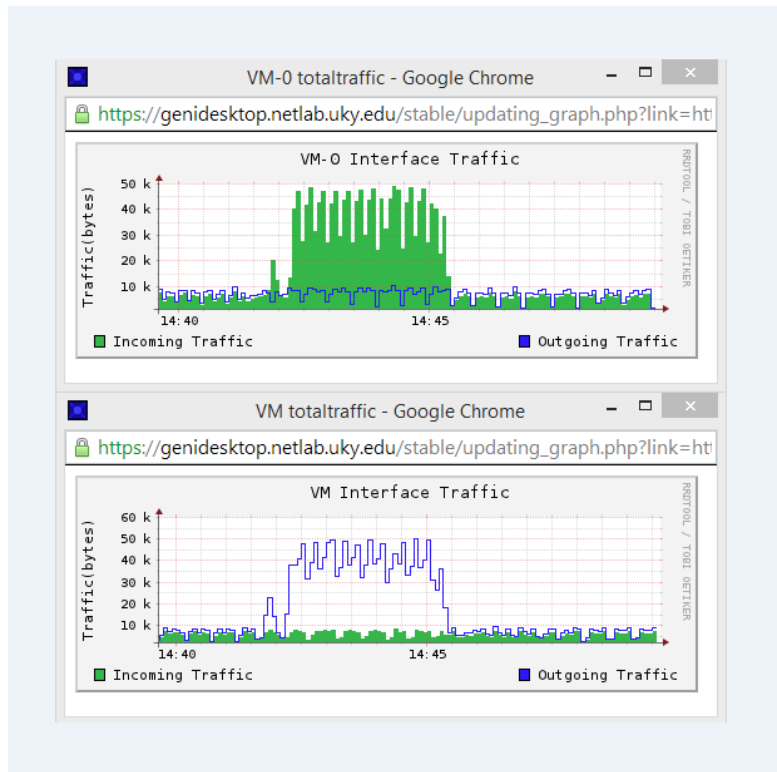
Part 1: Use Iperf between two nodes. Vary the window size per experiment (4KB and 32KB) keeping RTT constant at 50ms. Take a screenshot of the graphs from both nodes after each experiment has completed.

Part 2: Use Iperf between the same two nodes above. Vary the RTT per experiment (50ms and 250ms) keeping window size constant at 32KB. Take a screenshot of the graphs from both nodes after each experiment has completed.

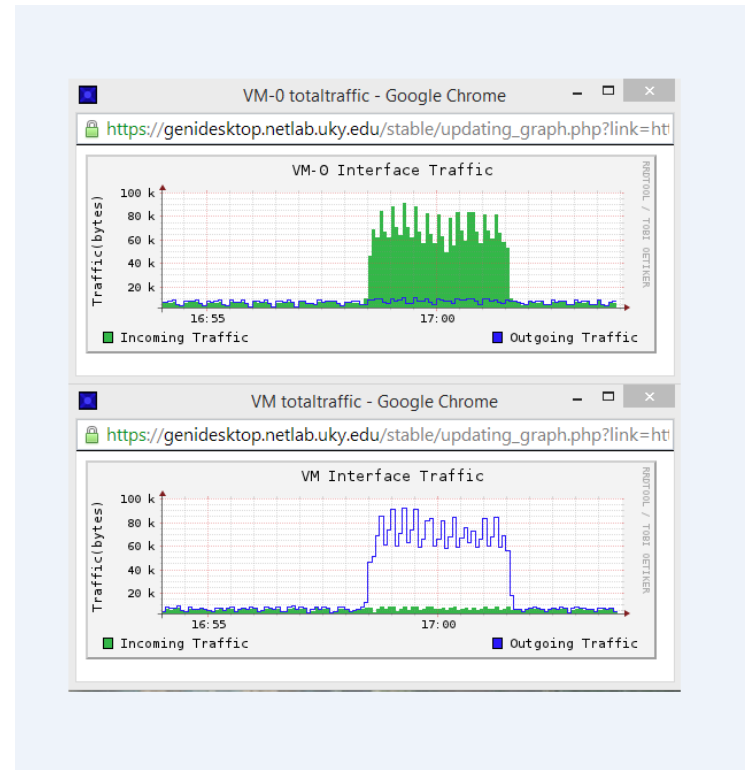
Part 3: Study the differences in average throughput among the four experiments. Explain this difference by referencing the TCP equation discussed in class.



Example: Assignment Modules



Window size: 4KB; RTT: 50ms



Window size: 32KB; RTT: 250ms



What's in a Module?

- Presentation material, canned demonstrations and/or detailed assignment instructions for the course instructor
- Sample solution set for assignments (for the instructor)
- We are testing these in our 120-student undergraduate networking course this semester



GENI Resources

- GENI Portal for setup and project management for instructors
- Flack
- GEMINI for instrumentizing, demonstrating results, graphs



Schedule

- Watch for our poster and demo at the session this evening!
- Sign up for our tutorial on using our modules at UC-Davis in June
- At least six modules available for Fall 2014 courses



We want your Input

- Would you use these in your class?
 - Why or why not?
- What changes would you recommend we do to make this more usable in your classroom?
- If you were to pick three modules (demos or assignments) you would like to see by Fall 2014, please list them (please send email: aikat@cs.unc.edu)



Feedback

- Please tell us what you would like to see – if you give us a specific demo or assignment to create (expecting to use it in your class this Fall), talk to us!

aikat@cs.unc.edu

- Cloud Computing: Teach the Teachers workshop @ UNC



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Thank you!

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