TLEN 5832 Network Performance and Analysis
Spring 2015

Instructor: Dan Hembree
Time/Place:
    Thursday: 6:30PM – 9:00PM
    Room: ECEE 283

Instructor Contact Info:
Cell Phone: 720-490-3532
Email: daniel.hembree@colorado.edu
Office Hours: By appointment

Course Objective:
The purpose of this class is to provide students with an introduction to Ops Science. Emphasis is placed on the strategies and methodologies surrounding performance and measurement of a highly resilient network. The first part of the class will be structured around Network Performance. While the second half will be focused on Network Analysis using such tools as Wireshark.

Network Operations is an exciting way to start a telecommunications career. The possibilities after gaining valuable Network Operations Center (NOC) experience can grow in to Network Engineering and Network Architecture roles within a company. The new class titled “Network Performance and Analysis” has a goal of arming students with the valuable skills and tools that they need to hit the ground running in most NOC’s within a company. Topics will range from technical to soft skills and include addressing subjects such as Network Performance Metrics and Network Analysis best practices and the key theories behind them.

Course Outline

Network Performance

- Quick Review of the OSI Model
  - Emphasis on what layers we will spend the most time on and why.
- Network Topology Review
  - Review of a typical ISP network.
  - Overview of services/traffic that traverse the network – Internet, Digital Voice, etc
- Network Performance Defined
  - Determining the cause of network performance issues.
  - Uncover any bottlenecks in network traffic.
  - Open Source tools.
  - Monitoring network performance.
- Fundamentals of a Resilient Network
  - High System Availability
  - Technology behind it.
  - Strategy
• 5 9’s explained
• Establishing a High-Availability Network
  • Introduction: Why do we need it? What is it?
  • Metrics: MTBF, MTTR etc.
  • Basic Math of High Availability.
• Protocol Review
  • Latest Protocol Review
  • Troubleshooting/Analyzing Strategies.
• Quality of Service
  • Determining when to deploy
  • Deployment strategy
  • QoS Features.
• Network Performance Module/Toolkit
  • Determining the cause of network performance
  • Tools to assist: Netperf, dbs, and ntop, etc.
  • Monitor network performance using select programs.

**Network Analysis**

• Network Performance Measurement and Analysis
  • What metrics to review.
  • How to get them.
  • What to do with them.
  • Measurement: Tools and Techniques
  • Analysis: Statistics, queuing models, and Simulation.
• Network Management Systems
  • Basic ingredients of a network management system.
  • Network Management Metrics.
  • What and how to poll network elements.
• Auditing and Compliance
  • What to look for.
  • How to report.
  • Tools of the trade.

**Homework:**
• Writing Network Outage Reports.
• Questions from the reading assignments

**Labs/Projects (Subject to Change):**
• 4 Wireshark Labs
• Capacity Planning Exercise
• Forecasting network growth and relating that to availability and capacity.
• Calculating network availability.
Grades:
- Class Participation: Can influence your grade +/- . It is important to come to class each week and be involved.
- Homework: 25%
- Mid Term: 20%
- Final Exam: 30%
- Lab / Write ups: 25%

Grading Policy:

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Required textbook:
No required textbooks. But, there will be several required readings from the below references, that will be provided.

References:
Network Performance Section:
- **Network Management: Accounting and Performance Strategies** – Cisco Press

Network Analysis Section:
- **Wireshark 101**: Essential Skills for Network Analysis. Laura Chappell.

**Video:**
99 Problems but a switch ain't one - cisco parody
http://www.youtube.com/watch?v=AgXHc0xCcw

Change The Way You Think About Application Performance Monitoring for Distributed Applications
http://www.youtube.com/watch?feature=player_embedded&v=KMO_qm7V3iA

Network Forensics
http://www.youtube.com/watch?v=huendNBCr8Lk&feature=youtu.be

Readings:
- Performance Management Best Practices for Broadband Service Providers:
- Measure IP Network Performance:
  http://www.cisco.com/web/about/ac123/ac147/archived_issues/ipj_6-1/measuring_ip.html
- [CRZ00] Y. Chu, S. G. Rao, and H. Zhang, "A Case For End System Multicast", Proceedings of ACM SIGMETRICS'00, Santa Clara, CA
Some university policies:

**Policy Regarding Disabilities** - If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and www.Colorado.EDU/disabilityservices.

**Policy Regarding Religious Observance** - Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, it is your responsibility to notify faculty at least two weeks in advance of the conflict to request special accommodation for your religious observance. In general, one day religious holiday is not qualified as a reason for a delayed homework. In the case of conflict of religious holiday with exam, special arrangement can be made.

**Policy Regarding Classroom Behavior** - Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student’s legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

**Sexual Harassment Policy** - The University of Colorado Policy on Sexual Harassment applies to all students, staff and faculty. Sexual harassment is unwelcome sexual attention. It can involve intimidation, threats, coercion, or promises or create an environment that is hostile or offensive. Harassment may occur between members of the same or opposite gender and between any combination of members in the campus community: students, faculty, staff, and administrators. Harassment can occur anywhere on campus, including the classroom, the workplace, or a residence hall. Any student, staff or faculty member who believes s/he has been sexually harassed should contact the Office of Sexual Harassment (OSH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the OSH and the campus resources available to assist individuals who believe they have been sexually harassed can be obtained at: http://www.colorado.edu/sexual harassment/

**Policy Regarding University Honor Code** - All students of the University of
Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and at http://www.colorado.edu/academics/honorcode/.