CPE6510 – Resilient Networks – Spring 2016

Course Overview

**Course Description:** This course presents reliability and fault tolerance for network-centric systems, including models, metrics, and analysis techniques. This course also concentrates on security, including technical tools and methods for audit and assessment as well as management and policy issues. Note that in addition to lectures, students read and present summaries of current research papers and execute a project. (Co-listed with SysE 6322)

**Prerequisite:** SysE 6321 ⁄ CPE 6410 or CPE 5420

**Class Number:** On Campus: CPE: 72517 & SysE: 72519 – Distance Education: CPE: 72518 & SysE: 72520

**Credit Hours:** 3.0

**Time:** Th @ 4:00 pm – 6:30 pm

**Location:** Library G14 and Distance Education

**Instructor:** Egemen K. Çetinkaya

**Instructor Contact Information:**

132 Emerson Electric Co. Hall  
301 W. 16th St.  
Rolla, MO 65409-0040

Phone: +1 573 341 6887  
E-mail: cetinkayae@mst.edu  
Skype: starpasha2004

**Instructor Office Hours:** TR @ 1:30 pm – 2:30 pm or by appointment

**Administrative Assistant:** Ms. Carol Lay, +1 573 341 4509, layc@mst.edu, 143 Emerson Electric Co. Hall

**CPE 6510 Spring 2016 Syllabus:** This syllabus is for all sections of this course
# Course Schedule

**Tentative schedule** of lectures, readings, assignments, and exams. Dates in the future subject to change.

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Notes</th>
<th>Announcements, Readings, and Discussions</th>
<th>Student Presentations</th>
<th>Project Milestones</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 January 2016</td>
<td>Course Overview Networking Background</td>
<td>N/A</td>
<td>N/A</td>
<td>Project overview, expectations, and planning</td>
</tr>
<tr>
<td>28 January 2016</td>
<td>Resilience Overview</td>
<td>[SHC+2010], [ALR+2004]</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>4 February 2016</td>
<td>Challenges and Tolerance</td>
<td>[EFL+1999], [SKH+2002], [ÇS2013]</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td></td>
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<td>[BGP Hijacking video: YouTube and Pakistan Telecom]</td>
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<td></td>
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<td>[CNN Overload video: CNN.com: Facing a World Crisis]</td>
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<tr>
<td>11 February 2016</td>
<td>Resilience Evaluation</td>
<td>[NST2004], [SCH+2013]</td>
<td>[BS2015]JM1</td>
<td>N/A</td>
</tr>
<tr>
<td>18 February 2016</td>
<td>Graph Theory Overview</td>
<td>[HRI+2008], [N2003]</td>
<td>N/A</td>
<td>Finalize project topics and groups</td>
</tr>
<tr>
<td>25 February 2016</td>
<td>Graph Robustness and Algorithms</td>
<td>[ACS2014], [ÇAP+2015]</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>3 March 2016</td>
<td>Network Security Overview</td>
<td>[CM2002], [YRL+2006]</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>10 March 2016</td>
<td>Midterm Exam Logistics</td>
<td>Midterm Exam</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>17 March 2016</td>
<td>N/A</td>
<td>Spring Recess</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Date</td>
<td>Topic</td>
<td>References</td>
<td>Notes</td>
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<tr>
<td>31 March 2016</td>
<td>N/A</td>
<td>Spring Break</td>
<td>N/A</td>
<td></td>
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<tr>
<td>7 April 2016</td>
<td>Critical Infrastructures</td>
<td>[RPK2001], [SHG2012], [YQS+2012]</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>14 April 2016</td>
<td>Security of Control Systems</td>
<td>[GH2013], [M2005], [ILW2006]</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>28 April 2016</td>
<td>Game Theory and Network Security</td>
<td>[MZA+2013], [LX2013]</td>
<td>N/A</td>
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<tr>
<td>5 May 2016</td>
<td>N/A</td>
<td>N/A</td>
<td>Project presentations during class</td>
<td></td>
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<tr>
<td>12 May 2016</td>
<td>N/A</td>
<td>No Final Exam</td>
<td>Project reports due</td>
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</tbody>
</table>

15 March 2016: Midterm grades due by instructor
21 March 2016: Midterm grades available via Joe'SS
17 May 2016: Final grades due by instructor
24 May 2016: Final grades available via Joe'SS
Course Materials

Books

There will not be a required textbook for this class.

Optional Books


**Supplementary Books**

(Note that this a mandatory book **and must be read** for anyone who wants start networking research with me.)

(E-book is accessible online via the [library](#).)

(E-book is accessible online via the [library](#).)

(Note that this was the required textbook for CPE 5420. E-book is accessible online via the [library](#).)

(Note that this is the required textbook for CPE 5430, Wireless Networks.)

(E-book is accessible online via the [library](#).)

(Note that this is the required textbook for CS 6001, Applied Graph Theory for Computer Science.)

(Note that this is the required textbook for CS 6001, Complex Networked Systems.)


(Note that this was the required textbook for SysE 6321/CPE 6410. E-book is accessible online via the [library](#) and [doi](#).)

(Note that this was the supplemental textbook for SysE 6321/CPE 6410. It is available online via [author's website](#).)

**Papers**


Potential Student Papers

Past Challenges

[JKR2002] “Flash Crowds and Denial of Service Attacks: Characterization and Implications for CDNs and Web Sites.”
[SPW2002] “How to Own the Internet in Your Spare Time,”

[SWA2002] “Understanding BGP Misconfiguration,”


[BLA2011] “Pingin’ in the Rain,”


[KLC2009] “Telecommunications Power Plant Damage Assessment for Hurricane Katrina—Site Survey and Follow-Up Results,”

Performance Evaluation


[HTD+2013] “Disaster survivability in optical communication networks,”

Graph Algorithms

[FDH+2015] “Disaster-aware datacenter placement and dynamic content management in cloud networks,”


[DAL+2005] “The ’robust yet fragile’ nature of the Internet,”

Security

[RZL2013] “On the features and challenges of security and privacy in distributed internet of things,”

[WXW2015] “Whispers in the Hyper-Space: High-Bandwidth and Reliable Covert Channel Attacks Inside the Cloud,”

[GKS+2015] “Cloud-Trust - a Security Assessment Model for Infrastructure as a Service (IaaS) Clouds,”

[WZL+2015] “DDoS attack protection in the era of cloud computing and Software-Defined Networking,”

[GAL+2015] “Agile Virtualized Infrastructure to Proactively Defend Against Cyber Attacks,”

[ZL2012] “Addressing cloud computing security issues,”

[ZCX+2015] “Robust Network Traffic Classification,”

Critical Infrastructures

[O2014] “Review on modeling and simulation of interdependent critical infrastructure systems,”

Control System Security


Smart Grid


Wireless


Game Theory


[MMO2015] “Formation Games of Reliable Networks,”

Course Policies

These policies are subject to change and students will be notified of any changes.

Correspondence

Don't hesitate contacting me outside of the office hours, but first confirm my availability via e-mail. Subject line of all e-mails regarding this class must start with: CPE6510 - followed by a meaningful indicator of the content. Otherwise, e-mails can be misfiltered and not read (faculty members receive many e-mails daily). If you don't hear from me within 48 hours, please resend the e-mail. I expect students will check their e-mails regularly for any announcements. We will primarily utilize the course website and (maybe) Blackboard during this class. I will utilize S&Tconnect for potential performance issues. You can also instant message me via Skype, but do not call on Skype before confirming my availability. The course Facebook page will be utilized to share news, interesting facts, discussions etc.

Attendance

On-campus students are expected to attend all classes. Students enrolled in the distance education section of the course are encouraged to participate in the live class, but are welcome to watch the archived lectures instead. Note that 5% of the course grade is constituted by student participation activities such as in-class interactions. Attendance to the midterm exam, which will be administered during the class time (Midterm Exam: 10 March 2016), and in-class project presentations (5 May 2016) are mandatory. Distance students will be required to take the exam with a webcam and headset or by an approved proctor during the normal class time. There will not be make-up options for these unless prior arrangements are made, or in the event of emergencies and sudden illness (which must be documented by the student). If you are in a state of contagious illness (e.g. Flu, Ebola), don't come to the class but notify me ahead of time. Flu shots are recommended for everyone. Distance students will be required to present their presentations with a webcam and headset during normal class time (preferred) or a previously recorded presentation if unable to present live (check for recording a presentation in PowerPoint by VCC).

Classroom Courtesy

We will physically meet in the Library G14 and the lectures will be webcast as well as archived. Students are expected to be prompt to the class. Due to interference with the recording system, I will ask everyone to turn off their cellphones (not even silence or vibrate!). Please avoid typing or eating snacks near the microphones as it creates annoying noise to others.
Assignments

Assignments are due on the due date at **11:59 pm**. Unless prior arrangements are made, late assignments are not accepted. Assignments must be sent either in pdf as an attachment or plaintext e-mail format.

Readings

Students are expected to read all required readings **before** the corresponding lecture. While most paper readings are hyperlinked to a version that is available on the author's webpage, some are not; however, all papers are available via the library.

Presentations

Students are expected to give 2-3 presentation(s) in the corresponding class throughout the semester based on a **scholarly paper**. Each presentation is expected to last ~25 min. Student initials are marked (e.g. JM1 Joe Miner1) in the schedule. You will be required to search for a paper/topic and send at least three options one week prior to your presentation. Presentations must be sent 48 hours in advance so I can provide feedback to you. You can use the presentation guidelines found in this **template**. Presentations will be evaluated based on the following **scoring rubric** (thanks to Vicki Hopgood for the rubric).

Computer Labs

The Linux desktops are located in **EECH 107 & CS 213** and you can **SSH** into these machines using **VPN**. The Windows PCs are located in **EECH 105 & 106**. I expect that students will use the computing resources according to the **MST IT Policy**. If you need resources for any intrusive testing or programming, contact me first. If you have computer-related problems, contact **IT Help Desk**.

Collaborative Software Support

For WebEx problems, contact **Video Communications Center (VCC)**. For **Blackboard** problems, contact **Educational Technology (EdTech)**.

Title IX

**Missouri University of Science and Technology** is committed to the safety and well-being of all members of its community. **US Federal Law Title IX** states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Furthermore, in accordance with Title IX guidelines from the US Office of Civil Rights, Missouri S&T requires that all faculty and staff members report, to the Missouri S&T Title IX Coordinator, any notice of sexual harassment, abuse, and/or violence (including personal relational abuse, relational/domestic violence, and stalking) disclosed through communication including but not limited to direct conversation, email, social
media, classroom papers and homework exercises. Missouri S&T's Title IX Coordinator is Vice Chancellor Shenethia Manuel. Contact her directly (manuels@mst.edu; (573) 341-4920; 113 Centennial Hall) to report Title IX violations. To learn more about Title IX resources and reporting options (confidential and non-confidential) available to Missouri S&T students, staff, and faculty, please visit http://titleix.mst.edu.

**Disability Support**

If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to meet with me early in the semester. You will need to request that the Disability Support Services staff send a letter to me verifying your disability and specifying the accommodation you will need before I can arrange your accommodation.

**Academic Integrity**

Academic integrity is an essential part of your success at MST (and thereafter). Academic dishonesty such as cheating, plagiarism, or sabotage is prohibited, and MST policy will be followed upon any instance of these. Following are the guidelines:

**Homework**

- You can discuss homework with each other, but cannot write up together.
- You can use the Web/books/papers/library for finding a solution methodology, but do not search for a solution manual nor use an existing solution manual for your assignment.
- Any student who copies or permits another student to copy will receive a 0 for the assignment, and the MST policy will be initiated.

**Software**

- You can discuss code/pseudocode with each other, but cannot write the software together unless it is a group project.
- You can use software libraries available, but properly cite the source in your code as a comment.
- Any student who copies or permits another student to copy will receive a 0 for the assignment, and the MST policy will be initiated.

**Exams**

- You are expected to answer exam questions by yourself. No additional resources (e.g., programmable calculators, phones, cheat sheets, etc.) are allowed and cheating in the exams is forbidden.
- Any student who copies or permits another student to copy will receive a 0 for the exam, and the MST policy will be initiated.
Project Report

- You must not copy/paste your report from other resources.
- Proper citation is required for the work of others.
- I will utilize SafeAssign plagiarism detection software.
- Any student who plagiarizes will receive a 0 for the project, and the MST policy will be initiated.
- Below are some links that can be useful for the writing part of any submission:
  1. MST Writing Center
  2. Reference Sources and Literature Citation by James P.G. Sterbenz
  3. Academic Integrity and Plagiarism by James P.G. Sterbenz
  4. Writing Technical Articles by Henning Schulzrinne

Penalties vary from a warning up to expulsion from the university. Before your actions, I suggest you think twice, and save us headache. When in doubt, don't hesitate to ask me!

Grading

This course is intended for graduate level students. If you are not a graduate student or have not taken the prerequisites for this class, talk to me as soon as possible. The grade for graduate students cannot be lower than C.

<table>
<thead>
<tr>
<th>Grading Scale</th>
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<tbody>
<tr>
<td>Percentile</td>
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<tr>
<td>90-100</td>
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<tr>
<td>80-89</td>
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<tr>
<td>70-79</td>
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<tr>
<td>00-69</td>
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The weights of each component for the overall grade is as below:

<table>
<thead>
<tr>
<th>Grading Weights</th>
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<tbody>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>25%</td>
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<tr>
<td>20%</td>
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<tr>
<td>10%</td>
</tr>
<tr>
<td>40%</td>
</tr>
<tr>
<td>5%</td>
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**Important Notes:**

- There will not be a final exam in this class, thus the project is an important part of your grade.
- Midterm exam will cover topics from the beginning of the class to midterm exam, which will be administered on 10 March 2016.
- Online students **must** have a webcam and a headset (microphone and speaker) [for proctoring]. Ability to print and scan (either scanner or high resolution camera) PDF documents is required for the exams. Skype, Google Hangout or other software that enables seeing each other might be required.
- Exam will cover every topic we discuss in class (including student presentations).
- Each student is expected to present 2-3 papers throughout the semester. The in-class student presentations will contribute 20% of the overall grade. Presentations will be evaluated based on the following **scoring rubric** (thanks to Vicki Hopgood for the rubric).
- There will be occasional homework assignments and quizzes to provide you and me with feedback of your understanding of the course topics.
- Participation grades will be based on questions asked, interactions, leading discussions, finding the bugs in lecture notes and course website, recommendations for reading, etc. Distance students are encouraged to participate during live class sessions but will not be penalized if unable to. Participation for asynchronous distance students will rely on e-mail messages.
- Employer reimbursement and immigration status cannot be a consideration in the final grade.
- Publishable projects are subject to extra credit.

**Feedback**

Do not hesitate to contact me if you have opinions to improve the course. You don't have to wait until end of semester.
Project Prospects

Students are expected to explore a topic of their choice that is relevant to the class in detail through the project. Project teams will be formed of at most three students (generally two) per team. Distance students will be assisted in forming teams and are encouraged to collaborate via Skype/Google Hangouts and work together using services such as Dropbox. The project grade contributes a major portion of the final grade. The overall project grade (extra credit will be given for publishable projects with my guidance) will depend on:

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Component</th>
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</thead>
<tbody>
<tr>
<td>40%</td>
<td>Novelty of ideas and results</td>
</tr>
<tr>
<td>40%</td>
<td>Project report</td>
</tr>
<tr>
<td>20%</td>
<td>Project presentation</td>
</tr>
</tbody>
</table>

Project reports must be sent only in pdf format. Final reports should be in total length of 10-15 pages. You can use this MS-Word template or LaTeX template for project reports. Students must submit the deliverables according to the following dates:

<table>
<thead>
<tr>
<th>Due Date</th>
<th>Deliverable</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 February 2016</td>
<td>Project title and group members</td>
</tr>
<tr>
<td>24 March 2016</td>
<td>Project report draft - title, abstract, outline</td>
</tr>
<tr>
<td>21 April 2016</td>
<td>Project report draft - solid draft with references</td>
</tr>
<tr>
<td>5 May 2016</td>
<td>Project presentations during class</td>
</tr>
<tr>
<td>12 May 2016</td>
<td>Project reports due</td>
</tr>
</tbody>
</table>

Project teams and topics are as below:

<table>
<thead>
<tr>
<th>Team (initials)</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>{JM1, JM2}</td>
<td>Potential Project Title</td>
</tr>
</tbody>
</table>

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