Term report description

ECE 1150: Computer Networks

Assignment: Term report

Instructions: In this assignment, you are required to complete a report & short recorded presentation (5-10 mins) of a computer networks-related topic. This assignment should give you an opportunity to investigate a topic that is of interest to you in the computer network domain. This assignment helps and examines your ability to independently acquire new knowledge, which is important for all engineers.

Please complete your report on one of the suggested topics below. You can also propose another topic based on your interests in the domain. However, if you propose a different topic than the ones suggested, please submit your proposed topic via email to the instructor no later than the due date specified below.

You should complete this assignment in groups that will be assigned using CATME tool (comprehensive assessment for team member effectiveness). You are expected to make progress every week throughout the semester and discuss the literature you read with your group on a regular basis.

Your report is expected to be around 2500 words, and review no less than 7 representative technical references on the topic (for groups of 2 members and more than 7 for groups of more than 2 members - **note that technical references should not include generic blogs or news articles**). It is recommended to use the IEEE paper submission template ⤷ (https://www.ieee.org/conferences/publishing/templates.html) .

Suggested topics.

- Coding techniques that correct errors in data transmission, are called channel coding (e.g. Convolutional codes, block codes, turbo codes, etc.).
- Performance of Low power protocols for the Internet of Things (IoT), such as ZigBee, Thread, 6LowPAN. Example, investigate throughput changes as a function of devices density (number of devices per unit area) or the number of routers/hops along routing paths, etc.
- Networking protocols in space systems. Simulations of specific protocols used in space systems.
- Simulation of visible light communications, protocol (IEEE 802.15.7), and applications
- Dedicated short-range communications (DSRC) and its applications (e.g. Autonomous vehicles), & performance evaluation/simulation
- Body area networks, network protocols used in e-healthcare applications, simulation, and modeling

- Networking technologies for contact tracing. Investigate contact miss-detection and false alarms due to wireless imperfections.

In your report, describe the system and/or network protocols investigated and highlight, if applicable, the difference/similarity with Internet protocol (that will be covered in class). Describe the applications, advantages, and limitations of technologies you refer to. Try to relate network and application requirements with design and performance (e.g. data rate, range of transmissions, power, topology, etc.).

Your report should answer the following questions: why needed (for example, why need ZigBee and not directly use the Internet for connectivity)? what is the objective? How is the objective achieved (describe)? What is the achievable performance (e.g. rate, power, scalability)? what are the limitations/challenges/open issues? **You should simulate at least part of the system relevant to your topic.** Simulating a real network model could be the focus of your report (for example, use Python to simulate a mesh network and investigate trade-offs between different network parameters (e.g. range, power, number of devices in the network, etc.). **All members are expected to contribute to the simulation part of the report.** If a member is not contributing to the report, please do not write their names on the submission.

A simulation example: There are channel coding techniques that are incorporated in networks to correct errors (e.g. convolutional codes, turbo codes, etc). Check the channel coding technique used in a network protocol. Simulate transmission of a sequence of bits with and without channel coding and find the error rate. The transmission of bits is subject to errors due to noise in the channel and fading. These should be simulated as well. This is an example of simulation. You can decide to complete different simulations for your report. **The papers you read should give you an idea of what to simulate - so please choose the topic and corresponding references accordingly.**

You can use any simulation tool, e.g. Matlab, Python, others.

In this report, we are assessing two things

- Ability to conduct independent research, organize information and cite appropriate sources
- Ability to apply knowledge gained to an engineering problem. This is through simulating (at least part of) the system and demonstrating how you set up the simulation and why, and analyzing the observations from the simulation in a clear way. The observations from the simulation should reflect the theory. You can use any information in the course in addition to what you learned independently.

Requirements:

Sept 20:   Proposed topic (only needed if different than any of the suggested topics)

Oct (1st-week):   Abstract of your report (here you need to have an idea of what you are going to simulate, or if you will use the simulation example of channel coding we provided, you need to state that as well)

Nov (1st week):   Progress report

Nov. (last week):   Complete report & short recorded presentation

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Resources that you may find helpful in simulation:

- Python network simulation: https://networkx.org

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Please work effectively with your group. We will collect peer-assessment and welcome feedback. Any problems in the team should be discussed early on and not later in the term. I'd encourage you to do the following:

- Have rotating roles, where each month one member of your team claims a role. Roles can be
  - **Team Coordinator:** responsible for arranging meetings
  - **Team Monitor:** responsible for checking everyone is functioning and completing their part and reporting to the instructor any problems
  - **Team Recorder:** responsible for submission, and taking meeting minutes
- Respect everyone! We may think differently and have different backgrounds! This diversity should make the work stronger!