New York University
Computer Science Department
Courant Institute of Mathematical Sciences

Course Title: Data Communication & Networks **Course Number:** csci-ga.2662-001
Instructor: Jean-Claude Franchitti **Session:** 2

Assignment #2

I. Due

Thursday October 1, 2015 at the beginning of class.

II. Objectives

1. Learn application layer concepts.

III. References

1. Slides and handouts posted on the course Web site
2. Textbook chapter 2

IV. Software Required

1. Microsoft Word.
2. Win Zip as necessary.

V. Assignment

1. Problem 1 – Modeling the network usage/performance of HTML pages download

   Assuming you are surfing the Web and click on a link to an HTML page that never downloaded before, how much time will it take for your client browser to download the page? Please take into account the number of hops (and RTTs) it takes to obtain the IP address of the server hosting the page via a DNS lookup, the RTT and transmission time to communicate with the server hosting the various objects contained in the target HTML page, and consider the various HTTP configuration scenarios that were discussed in class.

2. Problem 2 – Analyzing network usage/performance improvements in mainstream Web architectures

   (a) Research and explain the Common Gateway Interface (CGI) architecture that was created in the mid-1990s to add support for transactional services

to Web based client-server applications. Model the performance of individual transactions in this context (only consider the transactional link used to invoke a remote program in your model).

(b) Research and explain the evolution of Web Frameworks since the mid-1990s and point out notorious performance improvements.

(c) Single Page Applications or "SPAs" are becoming the standard in modern Web frameworks based on Ajax and full stack approaches such as MEAN. Model a typical transaction scenario using SPAs, and explain the improvements achieved compared to earlier Web framework approaches.

3. Problem 3 – Mainstream Internet Electronic Mail

   (a) Research the approach, conformance to RFCs, and specific protocols used to send and receive mail via iCloud, Google, Yahoo, Aol, and Outlook. Explain each approach and its specific differentiators in detail.

   (b) What specific information can you obtain using email headers and how do you gain access to such in the various approaches mentioned in 3. (a). Please provide examples and corresponding screenshots as necessary.

4. Problem 4 – Network Management Tools

   (a) Research and document at least five tools that can be used to manage the basic network capabilities that were described in class so far (e.g., traceroute, ping, nslookup).

   (b) For each one of the tools identified in 4. (a), explain what type of information you can obtain using the tool and/or the service(s) it provides. Please provide examples and corresponding screenshots as applicable.

5. Problem 5 – P2P File Distribution via BitTorrent

   (a) Research and explain how DHTs are used in BitTorrent to create a distributed tracker. Please be as specific as possible and provide usage scenarios including peer churn.

   (b) What potential issues need to be considered to optimize the performance of DHT usage in practical BitTorrent deployments. Please provide examples of issues and suggested improvements and estimate the performance savings.

6. Save the file as a Word document.

7. Name the file "**firstname_lastname_hw_2.doc**" (e.g., "john_doe_hw_2.doc").

8. Email your assignment file to the course grader, and submit a hard copy to the professor by the due date.

Use the following naming convention in the subject line of the eMail:

"**DCN - firstname lastname - homework 2"**
(e.g.: "DCN – John Doe - homework 2").

In the case source code is submitted, include your name as a comment at the top of each file
(Note: all files submitted should include your name).

VI. Deliverables

1. Electronic:

   Your assignment file must be emailed to the course grader. The file must be created and sent by the beginning of class. After the class period, the homework is late. The email clock is the official clock.

2. Cover page and other formatting requirements:

   The cover page supplied on the next page must be the first page of your assignment file.

   Fill in the blank area for each field.

   NOTE:

   The sequence of the hardcopy submission is:

   1. **Cover sheet**
   2. **Assignment Answer Sheet(s)**

VII. Sample Cover Sheet:

Name _____ Date: _____
(last name, first name)
Section: _____

Assignment 2

Assignment Layout (25%)

☐ Assignment is neatly assembled on 8 1/2 by 11 paper.
☐ Cover page with your name (last name first followed by a comma then first name), username and section number with a signed statement of independent effort is included.
☐ Answers to Questions 1 to 6 are correct.
☐ File name is correct.

Answers to Individual Questions:

(100 points total, all questions weighted equally)

☐ Assumptions provided when required.

Total in points (100 points total): _____

Professor's Comments: