King Fahd University of Petroleum & Minerals
College of Computer Sciences and Engineering

CSE 552 - Network Management (3-0-3)
Fall 2006 (Term 061)

Course Projects

Monday, September 18, 2006

1 Introduction

Students will work individually or in groups of 2 on a practical project throughout the semester and will be expected to design and implement a network management system. They will have to deliver a report, a presentation and a demo at the end of the semester of their implementation. Students should decide on one project and discuss it with the instructor before they start. The project must be defined ASAP but no later than the 4th week (i.e., October 1-4, 2006).

2 Project Description

The students will define the project they are going to work on. The following are some guidelines to help you choose a project:

➢ The project must implement components of a network management system.

➢ The outcome of the project must be a working prototype that you can demonstrate at the end of the semester. For example, if you implement an SNMP manager, it should communicate with existing SNMP agents.

➢ You can choose your own project, but you must talk to the instructor about your plan before you start working.

➢ The project could be one of these three choices:

  o A real world project defined by a company that you implement and evaluate.

  o A network management tool that you define, implement and evaluate.

  o A system found in a research paper that you implement, evaluate, and compare results to.

3 Project Options

One example of projects you can work on is to design and implement an SNMP manager. You can use any tool that you can get for this. You need to implement at least the basic SNMP messages to be able to communicate with agents. In this case, you can test your application with

already existing agents. This should include the implementation of a partial MIB (Management Information Base).

3.1 *Some of the options you can choose from*

The manager can have an MDB (Management Database) where it stores values gathered from the different agents.

The manager can also talk to multiple agents. You may want to use multithreading to make the implementation more efficient.

Implement some configuration management functions such as configuration of parameters of a managed object, a MIB browser, network discovery, etc.

Implement some fault management functions such as alarms reporting, trouble ticket systems.

Implement some performance management functions such as collecting statistics and plotting the results.

Implement some security management functions such as an intrusion detection/prevention system.

Implement other functions of network management that were discussed in the class, and presented by some students.

You can choose to have a GUI for ease-of-use of your application.

You may want to implement a web-based manager with some of the above functions.

You can use any platform (e.g., UNIX, Windows, or Linux), any language (e.g., Java, C/C++, TCL/TK), any tools (e.g., net-snmp, JDMK based on JMX).

3.2 *What is expected?*

Your grade will be based on the amount of work accomplished and the number and efficiency of the components implemented. The demonstration represents 50% of the overall project grade.

A working prototype is expected at the end of this project, in addition to a report and a user manual.

3.3 *You need to follow these steps in your project*

- ➢ Survey of different options in developing an NMS, and choice of one
- ➢ Plan of implementation of the option chosen
- ➢ First prototype of the NMS
- ➢ Report and user manual
- ➢ Demo of the final implementation
- ➢ Presentation

4   Project Examples

4.1   Web-based Network Topology Discovery

The project involves designing and implementing a web-based discovery of all the agents in the network. The students will survey the different options for designing a web-based network topology discovery. Then, they will choose one design and devise a plan for implementation. A working prototype is expected at the end of this project, in addition to documentation and a user manual. Optionally, the prototype could allow for browsing MIB (Management Information Base) objects of the agents discovered.
- One version of this could discover layer-3 devices only.
- Another version could discover the spanning tree of a layer-2 network. This could also include the dynamic update of the status of links on the map as it changes in the real network.

4.2   WLAN Topology Discovery

The project involves designing and implementing a WLAN topology discovery tool. The prototype should implement the discovery of all the WLAN access points and their associated clients in the network (i.e., RF topology). It should store the information about the topology and about devices (e.g., name, IP address, some statistics, etc) in a database. A graphical representation of the topology could be added. The prototype should also keep track of the changes in the topology. It should display in real-time the status of the WLAN network including the loading (number of terminals connected, average packets/sec, etc) for each access point, and raise alarms when association/disassociation events occur.

4.3   Denial of Service Attacks Tracer

The project involves designing and implementing a detector and tracer of DoS (Denial of Service) attacks. The students will survey the different options for designing a DoS Attacks Tracer. Then, they will choose one design and devise a plan for implementation. The system could, for example, raise an alarm when a DoS attack occurs, trace the path of the attacker back to the origin of the DoS attack, and display this path.

4.4   Management of Peer-to-Peer Networks

The project involves designing and implementing a network management system for a peer-to-peer network. The students will survey the different options for designing a peer-to-peer network management system. Then, they will choose one design and devise a plan for implementation. The prototype should implement a network management system to monitor a P2P network. It should also adapt to changes in the network, such as a peer failure, etc. The system should raise an alarm when changes occur, and display the new NM hierarchy. Information about the NMS (e.g., hierarchy, etc.) and the peers (e.g., name, IP address, some statistics, etc.) should be stored in a database.

4.5   Web-based SNMP statistics collector

The project involves designing and implementing a web-based SNMP statistics collector. The students will survey the different options for designing the web-based statistics collector. Then, they will choose one design and devise a plan for implementation. A working prototype is expected at the end of this project, in addition to documentation and a user manual. The prototype should allow the configuration of parameters such as time of collecting statistics,

agents to communicate with, and type of statistics to collect. It may also implement a basic discovery of all the agents in the local segment of the network.

4.6   Performance Grapher
Uses statistics collected to compute and plot performance metrics such as link utilization, etc. This can also be web-based.

4.7   Trouble Ticket System
Uses the alarms sent by agents on the network to generate trouble tickets, and manage them until they are resolved and the ticket is closed. This can also be web-based.

5   Project Deliverables

The following are the deliverables expected from each group and the due date for each.

	Deliverables	Due date	Grade's weight
1	Project proposal and action plan	Saturday, October 7th, 2006	5%
2	Progress report	Saturday, November 25th, 2006	5%
3	Demo of first prototype of the NMS	November 26th-29th, 2006	10%
4	Final demo of the NMS	January 6th-10th, 2007	40%
5	Presentations	January 13th-15th, 2007	20%
6	Report and user manual	Wednesday, January 17th, 2007	20%

5.1   Project proposal and action plan

The project proposal and action plan is a document of 2-3 pages that includes a section on the project description and another on the project plan of implementation.

Project proposal
In this section you should define the project goal and scope. You should also include a detailed description of the project you plan to work on. This should include the expected final product to be delivered, the main components to be implemented, the tools to be used, and the overall work to be accomplished.

Project plan
In this section you should include a detailed plan of the project:
- A detailed tasks description
- Duration and due dates
- Clear deliverables
- Responsibility assignment
- Overall organization

5.2   Project Progress Report and First Demo

The progress report (2-3 pages) should include:

- ➢ Introduction
- ➢ Updated plan
- ➢ Description of accomplished work
- ➢ Description of unaccomplished work
- ➢ Any issues or problems encountered
- ➢ Conclusion

A meeting with the instructor will be scheduled during the same week to discuss your progress, and to demo the first prototype of your NMS.

The first demo will be evaluated based on the functionality and the limitations/problems/errors in the prototype and the following criteria will be used:

- ➢ Progress (How much is implemented) **25%**
- ➢ Code/demo (How much is working) **50%**
- ➢ Project well defined (Is project according to plan) **25%**

5.3   Final Demo

The final demo will be evaluated based on the functionality and the limitations/problems/errors in the system and the following criteria will be used:

- ➢ Level of accomplishment (Amount of work accomplished) **25%**
- ➢ The number and efficiency of the components implemented
  - o How much is implemented **25%**
  - o How much is working **25%**
- ➢ Source code (self, commented, structure, logic) **25%**

5.4   Project Final Report and User Manual

You are expected to submit the report, the user manual, and the code commented by the deadline. You can either have everything in a CD or send it to the instructor by email as a .zip file (if the file size is not very big). I need also to get a hard copy of the report and the user manual by the same deadline.

The report should include the following main sections:

- ➢ Introduction
- ➢ Objectives and Motivations
- ➢ Analysis & Related Work
- ➢ Framework Architecture & Design (including subsections on components design and interactions between them)
- ➢ Implementation (including tools used, classes, etc.)

- ➢ Functionality & Utilization (including how the tool can be used, for which applications, and by which companies, etc.)
- ➢ Evaluation (testing, experiments & results)
- ➢ Problems Faced
- ➢ Future Directions
- ➢ Conclusion
- ➢ References

The user manual should include all information and steps necessary for someone to install and use your system. If this requires installing and configuring tools/applications which are not usually installed by default, then you should include the configurations steps for these as well. You may also include snapshots as needed.

6 Late submission policy

All assignments (e.g., project report) submitted after the due date will have 10% of the assignment maximum grade subtracted for every late day. If the submission is one week late, the grade for the assignment will be 0. (e.g.; if you get a grade of 80% in one assignment submitted 2 days later than the due date, you'll only receive a grade of 60%).

7 References

The following is a list of web site to help you make the decision of what you want to work on:

- ➢ http://www.simpleweb.org/: provides links and information on network management, including software, RFCs and tutorials.

- ➢ http://net-snmp.sourceforge.net/ (Previously known as "ucd-snmp"): Various tools relating to the Simple Network Management Protocol

- ➢ http://joe.lindsay.net/webbased.html: The Web Based Management Page

- ➢ http://linas.org/linux/NMS.html: Linux SNMP Network Management Tools

- ➢ http://www.gaertner.de/snmp/welcome-3.7last.html: Linux CMU SNMP Project

References for similar projects done at other Universities:

- ➢ http://www.cc.gatech.edu/classes/AY2002/cs6255_fall/: Check the end of this web page for projects presentations.

Additional references on network management:

- ➢ http://www.caida.org/tools/: The CAIDA Tools site contains CAIDA tools and software as well as a taxonomy of available research and visualization tools.

- ➢ http://www.slac.stanford.edu/xorg/nmtf/nmtf-tools.html: Network Monitoring Tools

- http://www.topology.org/comms/netmon.html: Network monitoring

- http://www.lrg.ufsc.br/cnom/: Committee on Network Operation and Management

- http://www.geocities.com/iadhicandra/links3.htm: Resource Links Collection

- http://www.ibr.cs.tu-bs.de/projects/nmrg/: Network Management Research Group

- http://www.sce.carleton.ca/netmanage/resources.htm#links: NM Research Web resources

- http://www.simple-times.org/: The ***Simple Times*** is an openly-available publication devoted to the promotion of the Simple Network Management Protocol (SNMP).

- http://www.mibexplorer.com/

- Google ☺

- Chapters 12, 13, & 14 of the textbook