FISSEA 2007
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Networking & Information Security
Improving Online Learning Through Simulation

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Agenda

- About the University of Maryland University College
- Online learning environment obstacles
- Online Laboratory Implementation Framework (OLIF©)
- IT Guru/Simulation benefits
- Networking and security lab exercises overview
- Summary
• UMUC has more than 88,000 students worldwide, over 32,000 whom are Maryland residents offering programs tailored for working adults and other traditional students

• UMUC is a leader in Higher Education for Adults and Distance Education

• UMUC offers more than 600 courses and close to 100 undergraduate and graduate certificate and degree programs completely online via WebTycho

• UMUC educates the Military – 54,000 service members world wide at more than 130 locations

Reference: http://www.umuc.edu/ip/umucfacts_02.shtml
Obstacles in an Online Learning Environment

- Communication barriers
- Learner motivation
- Computer and technical problems
- Need for virtual labs
Online Laboratory Implementation Framework

- Decision Points
  - Make or buy
  - Cost
  - Course integration
  - Support
- SDLC Phases
  - Initiation
  - Analysis & Evaluation
  - Selection of Learning Technology
  - Design Integration
  - Implementation
  - Monitor & Adapt
- Perspectives
  - Instructional Designers
  - Management
  - Instructors
  - Students

Figure 9 - Online Laboratory Implementation Concept
OPNET IT GURU/Simulation Benefits

- Provides a rich suite of widely used telecommunications devices used in networking and security.

- Affords ability to build computer models so students can study common networking and security exercises in a safe online lab environment.

- Uses models and scenarios so students can study the behavior of communications networks and security implications.

- Ease of use
In phase one you will be learning to create a network from scratch.

Checklist for Phase 1

Create an OPNET directory
Place the nodes in OPNET
Name the nodes in OPNET
Link the nodes in OPNET
Verify the links in OPNET
Discuss as a team the questions for phase 1
Elect one team representative to post the answers in the WebTycho
Overview of Networking & Security Lab Exercises

- Overview of networking and security lab exercises
  - Undergraduate School
    - Baseline
    - Distributed Web Attack
    - Firewall to Stop a Distributed Web Attack
    - Denial of Service Attack
    - Using a Personal Firewall to Stop a Denial of Service Attack
  - Graduate School
    - Unauthorized Video Download
    - Proxy Server to Prevent Video Download
    - Unauthorized File Sharing
    - Packet Filtering to Stop File Sharing
  - Need OPNET 12.X version
    - Network Address Translation
**Baseline**
Reference scenario to compare the performance observed for future exercises.
Distributed Web Attack

**Problem:** Zombies overload the registration server CPU and memory resources.

**Solution:** Firewall blocks the zombie IP addresses (IP packets received from zombies' IP addresses are discarded.)
**Denial of Service**

**Problem:** The hacker uses the Zombie herd to exploit an unprotected FTP port on John Doe’s machine.

**Solution:** Personal firewall blocks packets addressed to the FTP port on John Doe's machine.
Course Integration

- Ensure that visualization supports the learning objectives
- Consider student learning curves
  - Undergraduate & Graduate
- Student motivation
- Flexible learning environment
- Focus on course content
- Step-by-step process
- Engage students as if they were in “live labs”
Results/Summary

I found the content covered in the OPNET assignment to enable me to attain mastery in networking was

<table>
<thead>
<tr>
<th></th>
<th>Not good at all</th>
<th>Not very good</th>
<th>Good</th>
<th>Very good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>10%</td>
<td>12%</td>
<td>50%</td>
<td>18%</td>
<td>10%</td>
</tr>
</tbody>
</table>

I found OPNET exercises and answers to be

<table>
<thead>
<tr>
<th></th>
<th>Much too challenging</th>
<th>Somewhat challenging</th>
<th>About right</th>
<th>A little easy</th>
<th>Much too easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>5%</td>
<td>45%</td>
<td>48%</td>
<td>2%</td>
<td>0%</td>
</tr>
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</table>
Results/Summary

Approximately how many hours did you spend on OPNET installation and assignments?

<table>
<thead>
<tr>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>0-3 hours</td>
<td>12%</td>
</tr>
<tr>
<td>4-7 hours</td>
<td>22%</td>
</tr>
<tr>
<td>8-11 hours</td>
<td>32%</td>
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<tr>
<td>12-15 hours</td>
<td>18%</td>
</tr>
<tr>
<td>16-19 hours</td>
<td>8%</td>
</tr>
<tr>
<td>20-23 hours</td>
<td>2%</td>
</tr>
<tr>
<td>More than 23 hours</td>
<td>5%</td>
</tr>
</tbody>
</table>

Did the OPNET assignment work well in terms of design of content (e.g., graphics, appropriate use of multimedia, links, white space, etc.)

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not well at all</td>
<td>12%</td>
</tr>
<tr>
<td>Not well</td>
<td>22%</td>
</tr>
<tr>
<td>Somewhat well</td>
<td>32%</td>
</tr>
<tr>
<td>Very well</td>
<td>13%</td>
</tr>
<tr>
<td>Exemplary</td>
<td>8%</td>
</tr>
</tbody>
</table>
Results/Summary

Did this course (with the use of simulation) meet your expectations?

- Yes: 70%
- No: 30%
Conclusion

- Student outcomes and success
  - What are the main networking concepts you learned from the OPNET projects?
    - “DOS Attack”
    - “The concept of network security”
    - “How easily a network can be attacked”
    - “Packet Filtering and routers”
    - “Setting up personal firewall”
    - “Server, workstation, router, and firewall iterations and functionalities.”
    - “The main concepts I learned from the projects was the seriousness of web based attacks.”
    - “The use of firewalls and an ACL.”
Conclusion - Summary

Student satisfaction (Student’s comments)

- “Before the class I had very little networking experience. I feel like I have a much better grasp now, though.”

- “The simulation was very helpful in getting hands on knowledge of what we were learning.”

- “It helped drive the points home, by actually doing the stuff, not just reading about it.”

- “As this was my first online course with simulation software, I was very pleased with the course. I have heard people I work with speak of simulation software and how useful it was in learning things and I now have to agree with them. I feel it is extremely useful and informative.”

- “I understood what I wanted from the course and it met or exceeded my expectation.”

- “Perfect for working adults with limited time to schedule in actual lab time”

- “Yes, it was essential as it allowed me to be able to visualize how networks work and how all the information we learned fit into the real world.”
Conclusion - Continued

• Faculty ease of use
• Pros
  ▪ It gives students a feel for networking and security concepts without the expense of real hardware and software
    ▪ “It was useful because you could do what could never be done from home before”
    ▪ “Since the simulations were necessary OPNET allowed me to experience them since I do not have access to a lab where the simulations could have been performed.”
• Cons
  ▪ It still not real – students can’t make mistakes and see real consequences.
    ▪ “It is right there. That is the good thing about simulations, you can duplicate, but the only catch is that this is a controlled simulation. You can stop and start in a simulated environment, you have no control in a production environment.”
• Growing horizon for additional learning objects
• Questions?

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