



University of Maryland University College

An Online Hands-On Lab for Information Assurance

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Challenges

- To provide online students with hands-on experience to enhance their learning
- To help students to apply the theories and concepts that they have learned
- To prepare students for the challenges in real life
- To initiate faculty's interest in researches on virtual labs

Solutions

- Designed and set up a remote-access Network Systems and Security Laboratory
- Designed and developed various types of lab exercises for students
 - Remote-access lab exercises
 - Simulated lab exercises
 - Off-line lab exercises

Intellectual Merits

- The challenges for students
 - Solve real-life problems
 - Go beyond the textbooks
 - Work in teams in virtual environment
- The use of open-source software
 - Develop extra plug-ins and rules for Snort, an open-source software-based intrusion detection and intrusion prevention system
 - Save substantial cost in using the open-source solutions such as VMware ESXi server, VMware Server, Snort, WireShark, etc.
- The use of virtual platforms
 - Easy to manage and maintain
 - Easy to use multiple operating systems in one environment
- The easy access for learners
- The promotion of innovative design

Broader Impact

- Easy adoption of the model in other disciplines
- Support of interoperability
- Promotion of research
- Improvement of teaching in the online environment

Network Systems and Security Laboratory and Lab Exercises

● Designed using a life-cycle model:

- Gathering requirements
- Analysis
- Design
- Implementation
- Testing
- Modification
- Maintenance

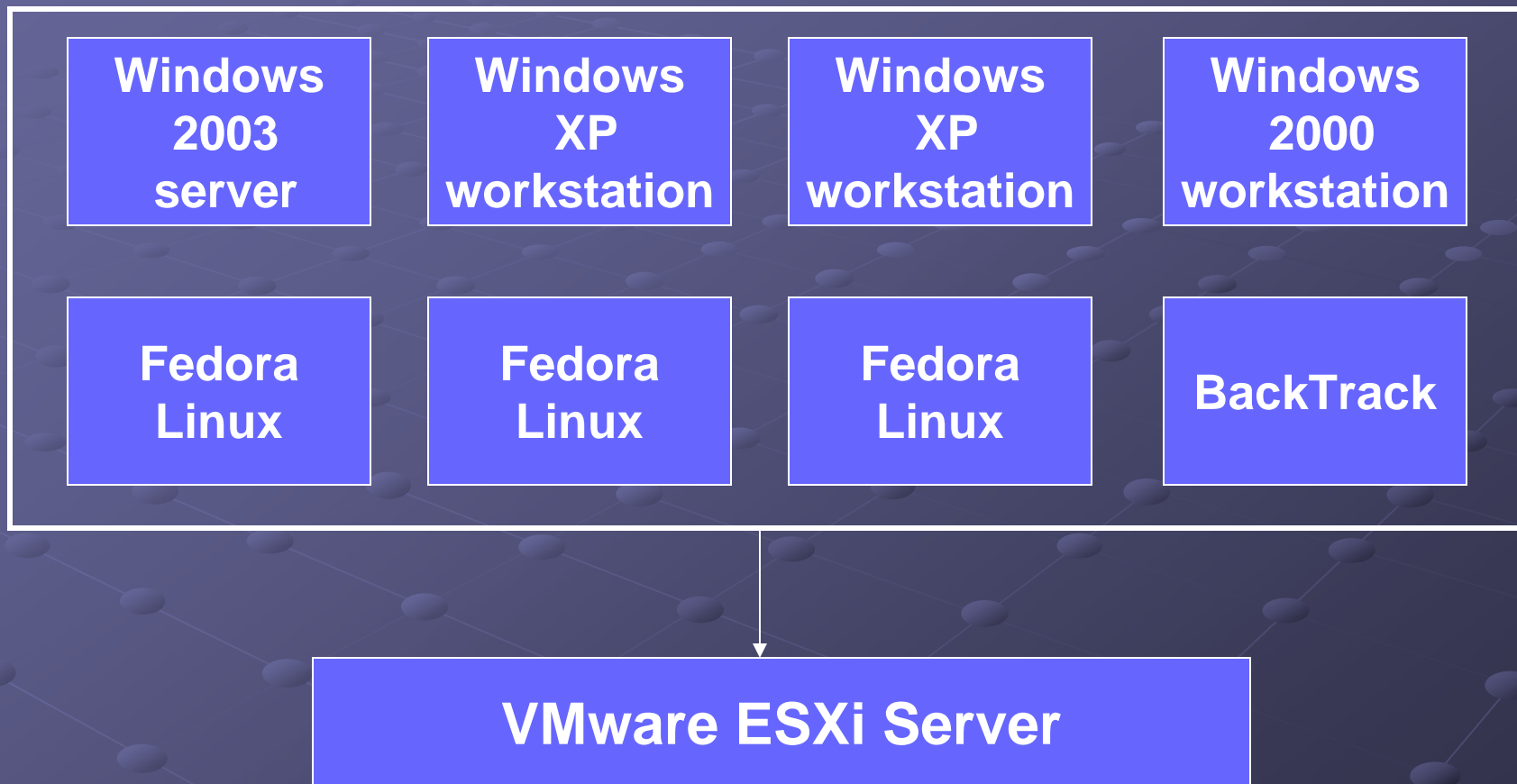
Remote-Access Lab

- Use VPN connection to get access to a closed network with different networking, security, and computer devices
- Use hardware devices such as routers, switches, firewalls, intrusion detection and intrusion prevention systems, etc.
- Use software such as network traffic sniffers, intrusion detection tools, vulnerability assessment tools, etc.
- Use virtual platforms such as VMware ESXi server and VMware Server
- Support lab exercises such as computer security, network security, intrusion detection and prevention, computer and network forensics, etc.

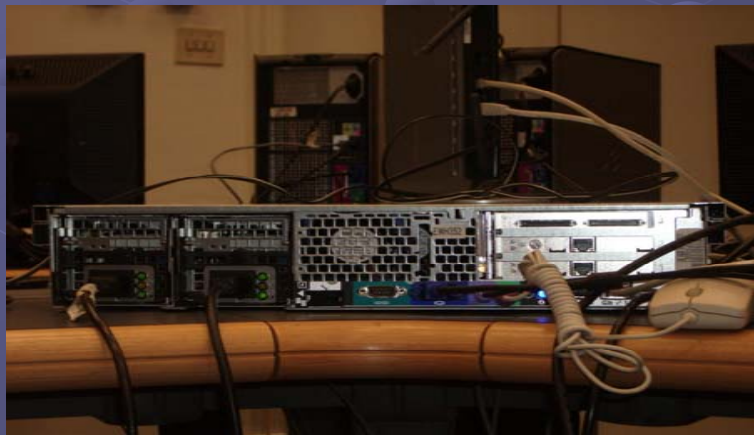
Network and Security Equipment



VMware Solution



Using One VMware Server to Replace Multiple Computers



VMware Solution and Its Benefits

- VMware ESXi server and VMware Server: free of charge
- Install multiple instances on one physical platform
- Benefits:
 - Easy to use
 - Easy to manage
 - Small physical footprint
 - Efficient use of resources (space and time)
 - Cost saving
 - Able to support an increasing number of students
 - Able to work with multiple operating systems in one environment
 - Able to have better utilization of Backtrack tools

Remote-Access Lab Demo

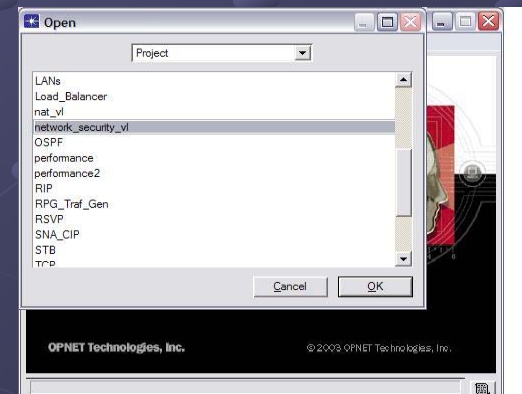
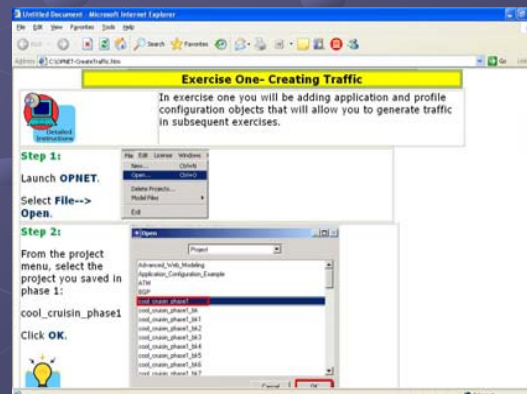
- Lab exercises in access control
- Lab exercises in intrusion detection and intrusion prevention on virtual platform
- Lab exercises in vulnerability scanning on virtual platform
- Lab exercises in network forensics on virtual platform
- Other relevant lab exercises

Simulated Lab Exercises

- Use OPNET simulation software
- OPNET ITGuru: free for academic institutions
- OPNET ITGuru: may be run either on a server or on a workstation
- Support lab exercises such as network traffic performance analysis and network security

Simulated Lab Exercise Demo

- UMUC OPNET IT Guru Exercises:
 - Cool Cruisin' Exercises
 - Network Security Exercises



Off-Line Lab Exercises

- Use free computer forensic tools
- Use free encryption tools
- Support lab exercises such as computer forensics and encryption

Off-Line Lab Exercise Demo

- Computer Forensics
- Encryption

Benefits of Online Hands-On Lab

- Provide easy access to the remote lab from anywhere in the world
- Serve significantly more learners with limited resources with the help of virtual platforms
- Have the potential of expanded services
- Provide great convenience to learners
- Save cost substantially, especially in using the virtual platforms set up recently
- Encourage team work

Benefits of Online Hands-On Lab

- Generate learning atmosphere
- Enhance learners' engagement
- Challenge learners to figure out “out-of-box” solutions
- Promote critical thinking and creativity
- Improve teaching quality in the online environment

Assessment

- Show how the online hands-on lab exercises add value to the success of students
- Have practical tests at the end of a semester
- Also ask relevant questions in exams

Observations

- In exams, the average correct answer rate for the questions related to a lab exercise is higher than that for non-related questions
- In solving problems similar to real-life scenarios, some students have figured out solutions better than what they have learned from textbooks

Conclusion

- The online hands-on lab for information assurance at the University of Maryland University College has set up a model for other institutions in providing online hands-on labs
- It represents a radical improvement in access, affordability, and quality of education