



*Department of Electrical Engineering and Computer Science*

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

**6.893 Fall 2009**

## **Quiz II**

All problems are open-ended questions. In order to receive credit you must answer the question as precisely as possible. You have 80 minutes to finish this quiz.

Write your name on this cover sheet.

Some questions may be harder than others. Read them all through first and attack them in the order that allows you to make the most progress. If you find a question ambiguous, be sure to write down any assumptions you make. Be neat. If we can't understand your answer, we can't give you credit!

**THIS IS AN OPEN BOOK, OPEN NOTES EXAM.**

*Please do not write in the boxes below.*

<b>I (xx/10)</b>	<b>II (xx/30)</b>	<b>III (xx/10)</b>	<b>IV (xx/10)</b>
<b>V (xx/10)</b>	<b>VI (xx/20)</b>	<b>VII (xx/10)</b>	<b>Total (xx/100)</b>

**Name:**

## I KeyKOS

1. [10 points]: Bob is running the privilege-separated Zoobar web site on a KeyNIX system, using code from lab 3. Suggest a way in which Bob can modify the Zoobar server-side code to take advantage of KeyKOS capabilities to improve the security of his site, in a way that he wouldn't be able to do on Linux.

## II Network protocols

Bob logs into an Athena workstation, which uses Kerberos to obtain a ticket for bob@ATHENA.MIT.EDU, and then runs Bob's mail client, which contacts Bob's post office server to fetch new messages.

**2. [10 points]:** Alice doesn't want Bob to know about an upcoming event, which was announced to Bob via email. To this end, Alice plans to intercept Bob's communication with his post office server, and to pretend that Bob has no new mail. Alice can observe and modify all network packets sent by Bob. How does Kerberos prevent Alice from impersonating Bob's mail server? Be as specific as possible; explain how Bob can tell between Alice and the real mail server in terms of network packets.

Now, Alice wants to read Bob's email, and intercepts all network packets ever sent and received by Bob's workstation (which is the only computer that Bob uses). However, Alice does not know Bob's password to access Bob's post office server, and Bob's packets to and from the post office server are protected by Kerberos.

**3. [10 points]:** Suppose that after Bob reads and deletes all of his mail, Alice learns what Bob's password was. Describe how Alice can obtain Bob's past messages.

**4. [10 points]:** To prevent Alice from reading any more messages, Bob ensures that Alice cannot intercept any subsequent network traffic, and changes his Kerberos password. Could Alice still read Bob's mail after this? Explain why not or explain how.

### III ForceHTTPS

**5. [10 points]:** Bob is developing a new web site, and wants to avoid the problems described in the ForceHTTPS paper. He uses HTTPS for all of his pages and marks all of his cookies “Secure”. Assuming Bob made no mistakes, is there any reason for Bob’s users to install the ForceHTTPS plugin and enable it for Bob’s site? Explain why or why not.

## IV BitLocker

**6. [10 points]:** Alice wants to make BitLocker run faster. She decides that computing a different  $IV_s$  for each sector (pg. 13 in the BitLocker paper) is needlessly expensive, and replaces it with the fixed value  $E(K_{\text{AES}}, e(0))$  instead. Explain how an attacker may be able to leverage this change to obtain data from a stolen laptop that uses BitLocker in TPM-only mode.

## V Tor

**7. [10 points]:** Bob is running a hidden service on top of Tor, and wants to know how frequently he should choose new introduction points. Bob cares about his identity not being exposed, and about the availability of his service. Help Bob make an informed choice by explaining the costs and benefits of rotating introduction points either more or less frequently.

## VI BackTracker

**8. [10 points]:** Alice is using the VM-based BackTracker to analyze a compromised server, where an attacker obtained some user's password, logged in via SSH, exploited a buffer overflow in a setuid-root program to gain root access, and trojaned the login binary, all using high-control events that are still stored in the event logger. How can Alice figure out what *specific* vulnerability in the setuid-root program the attacker exploited? In what situations would this be possible or not possible?

**9. [10 points]:** The VM-based BackTracker system requires no modifications to the guest OS, but nonetheless makes assumptions about the guest OS. List assumptions that are critical to back-tracking attacks that used high-control events.

## **VII 6.893**

We'd like to hear your opinions about 6.893, so please answer the following questions. (Any answer, except no answer, will receive full credit.)

- 10. [10 points]:** If you could change one thing in 6.893, what would it be?

**End of Quiz**