# Phishing to Steal Your PC, Money, and Identity

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# Outline

- What is Phishing?
- Threats
- Defenses (Research?)

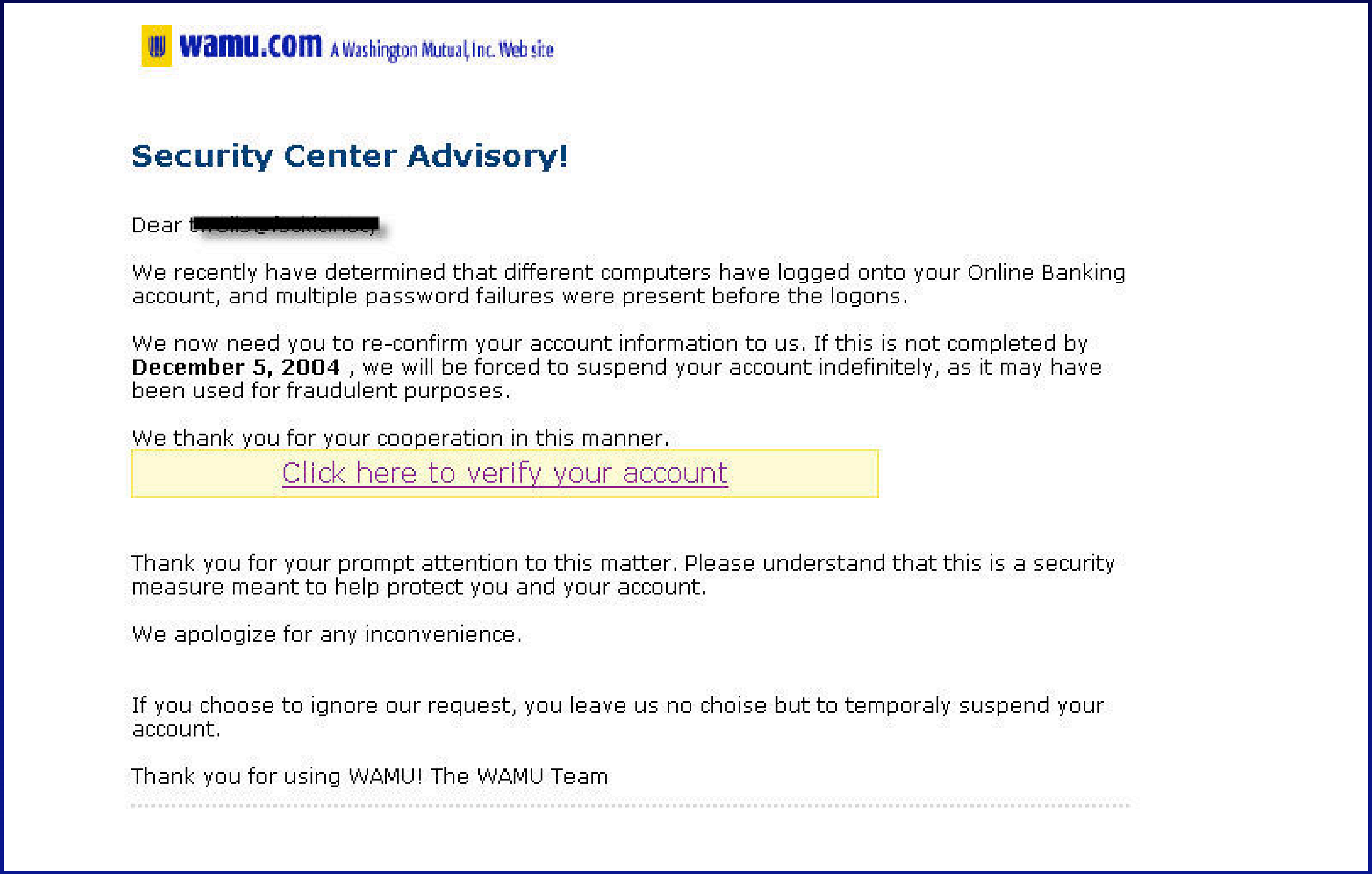
# What is Phishing?

- A social engineering attack:
  - Email message (type of spam) appears from financial institution asking to verify your account or transaction
  - Victim submits account info. at fake Website
  - Fake Website steals confidential personal info. or downloads malicious code

# Victims

- Consumers
- Financial organizations
  - Banks: Citibank, Wells Fargo, US Bank, NatWest, Barclays, Lloyds Bank,...
  - Credit card companies: VISA,...
  - Retailers: eBay, PayPal, Amazon,...
  - ISPs: AOL, MSN, Yahoo, Earthlink,...

# Example 1: email from Washington Mutual reports failed logins to online account and asks for confirmation of account info



wamu.com A Washington Mutual, Inc. Web site

## Security Center Advisory!

Dear [redacted]

We recently have determined that different computers have logged onto your Online Banking account, and multiple password failures were present before the logons.

We now need you to re-confirm your account information to us. If this is not completed by **December 5, 2004** , we will be forced to suspend your account indefinitely, as it may have been used for fraudulent purposes.

We thank you for your cooperation in this manner.

Click here to verify your account

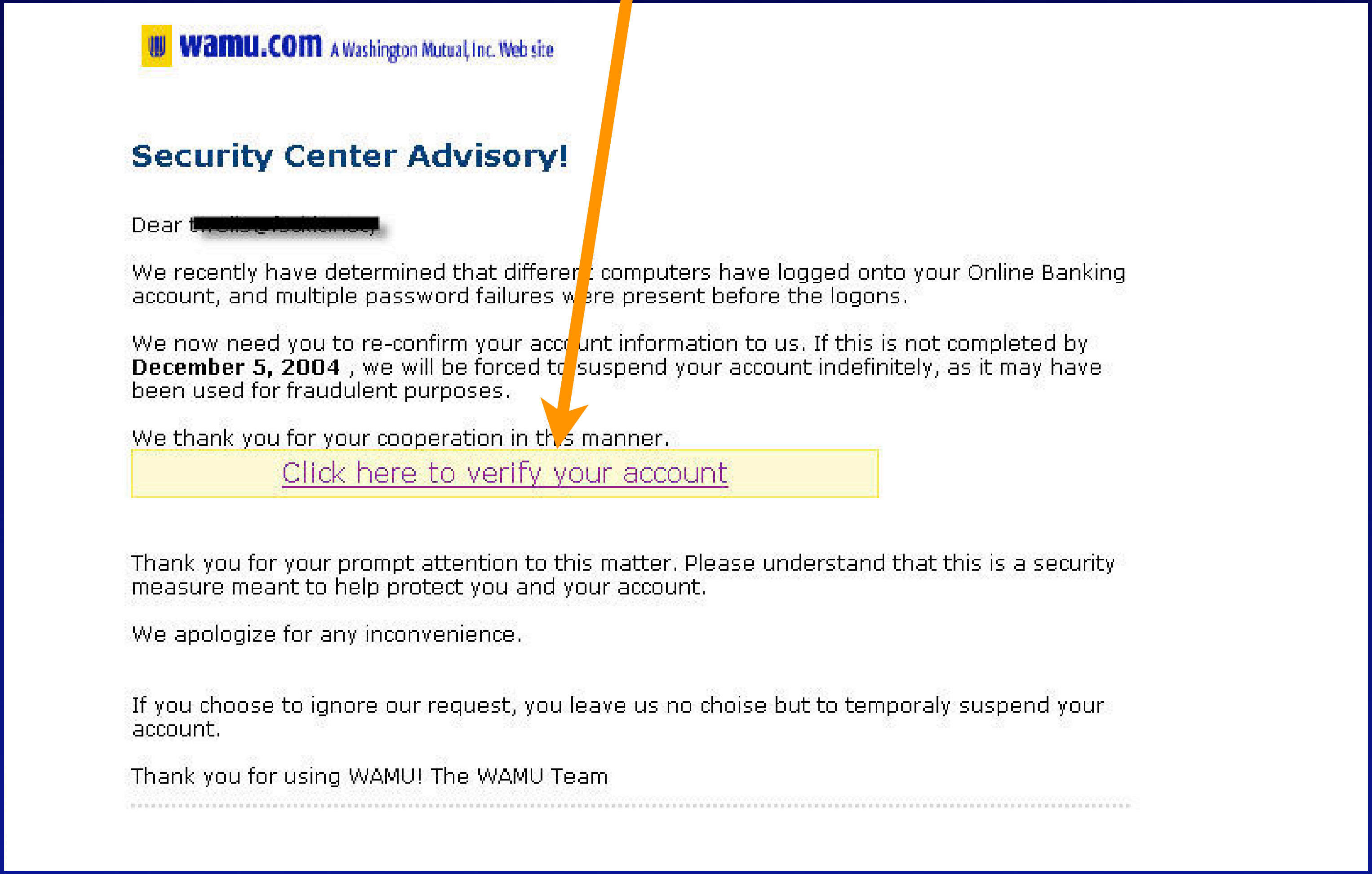
Thank you for your prompt attention to this matter. Please understand that this is a security measure meant to help protect you and your account.

We apologize for any inconvenience.

If you choose to ignore our request, you leave us no choise but to temporaly suspend your account.

Thank you for using WAMU! The WAMU Team

# Link to IP address 218.68.80.234 (in China)



## Security Center Advisory!

Dear [redacted]

We recently have determined that different computers have logged onto your Online Banking account, and multiple password failures were present before the logons.

We now need you to re-confirm your account information to us. If this is not completed by **December 5, 2004** , we will be forced to suspend your account indefinitely, as it may have been used for fraudulent purposes.

We thank you for your cooperation in this manner.

Click here to verify your account

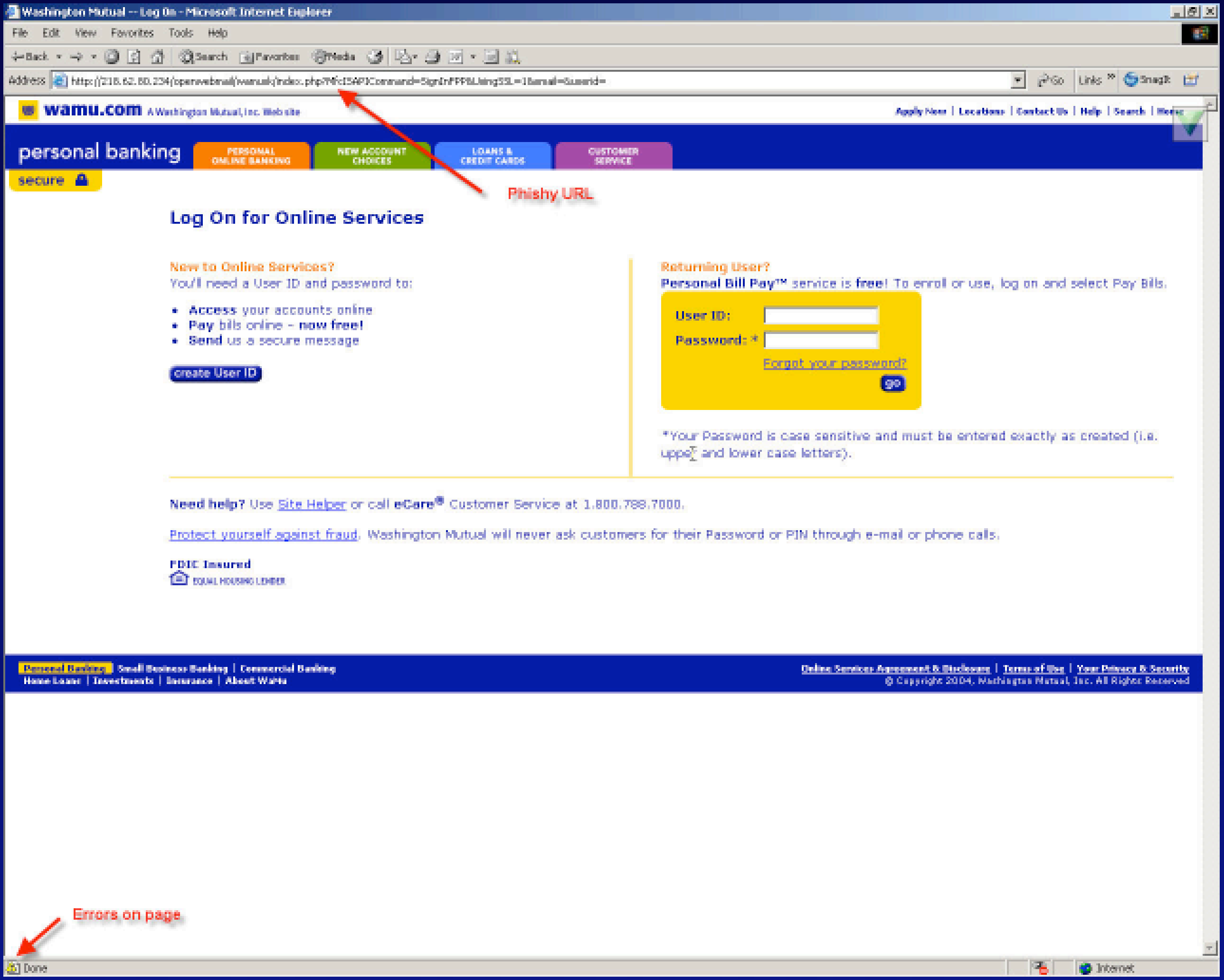
Thank you for your prompt attention to this matter. Please understand that this is a security measure meant to help protect you and your account.

We apologize for any inconvenience.

If you choose to ignore our request, you leave us no choise but to temporaly suspend your account.

Thank you for using WAMU! The WAMU Team

# Clues: Website shows long, strange URL “http://218.62.80.234/openwebmail/wamusk/....”


Washington Mutual -- Log On - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address
Go Links SnagIt
wamu.com A Washington Mutual, Inc. Web site
Apply Now | Locations | Contact Us | Help | Search | Home
personal banking
PERSONAL ONLINE BANKING
NEW ACCOUNT CHOICES
LOANS & CREDIT CARDS
CUSTOMER SERVICE
secure
create User ID
go
Personal Banking | Small Business Banking | Commercial Banking
Home Loans | Investments | Insurance | About WaMu
Online Services Agreement & Disclosure | Terms of Use | Your Privacy & Security
Done
Internet

http://218.62.80.234/openwebmail/wamusk/index.php?MfcISAPICommand=SignInFPP&UsingSSL=1&email=&userid=

Phishy URL

## Log On for Online Services

**New to Online Services?**
You'll need a User ID and password to:

- **Access** your accounts online
- **Pay** bills online – **now free!**
- **Send** us a secure message

**Returning User?**
**Personal Bill Pay™** service is **free**! To enroll or use, log on and select Pay Bills.

User ID:
Password: *
Forgot your password?

*Your Password is case sensitive and must be entered exactly as created (i.e. upper and lower case letters).

**Need help?** Use Site Helper or call **eCare®** Customer Service at 1.800.788.7000.

Protect yourself against fraud. Washington Mutual will never ask customers for their Password or PIN through e-mail or phone calls.

FDIC Insured
EQUAL HOUSING LENDER

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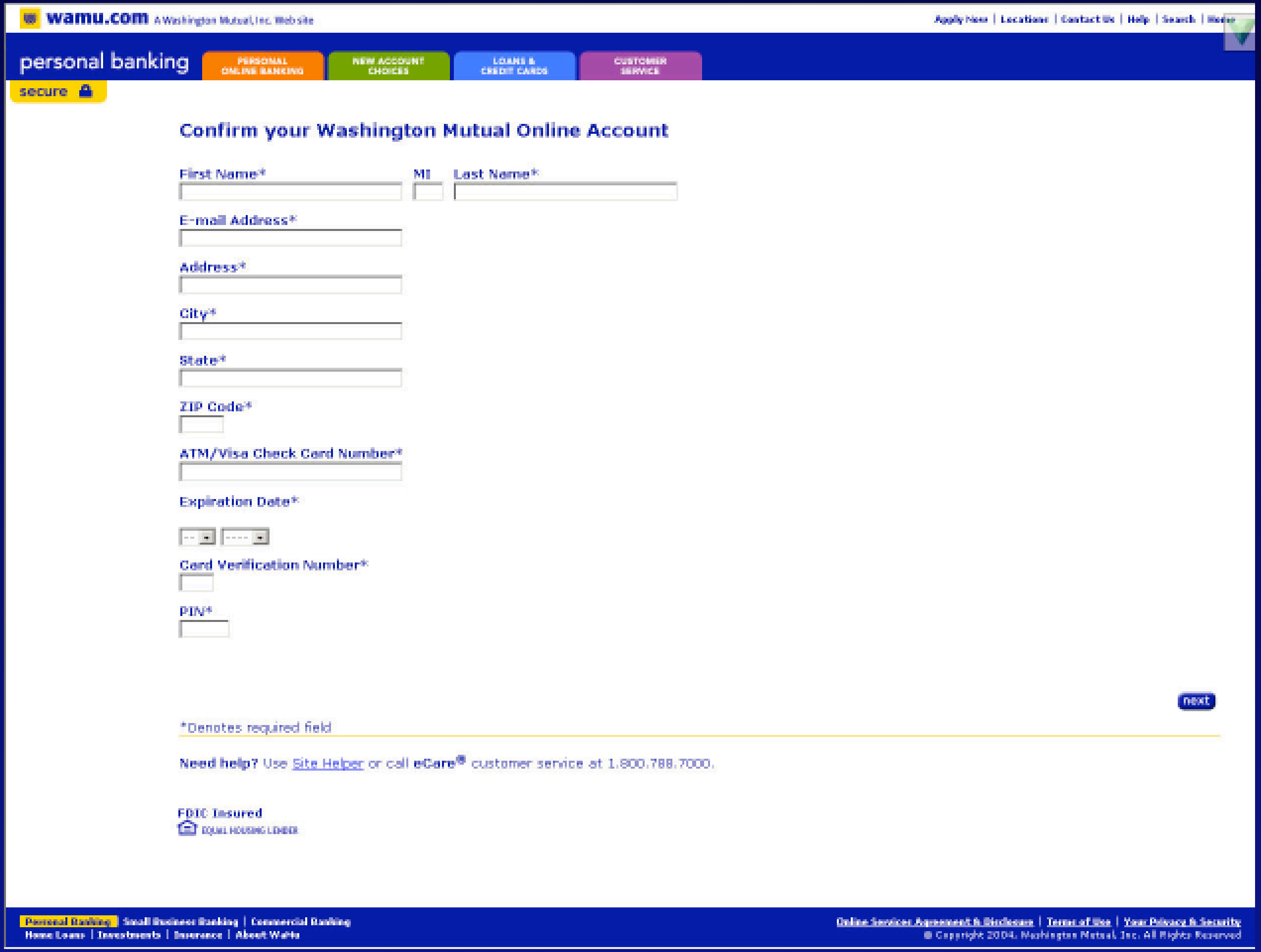
Errors on page

# IE shows rendering errors

# After user logs in, Website asks for ATM/Visa check card info



wamu.com A Washington Mutual, Inc. Web site
Apply Now | Locations | Contact Us | Help | Search | Home
personal banking
PERSONAL ONLINE BANKING
NEW ACCOUNT CHOICES
LOANS & CREDIT CARDS
CUSTOMER SERVICE
secure

Confirm your Washington Mutual Online Account

First Name*
MI
Last Name*
E-mail Address*
Address*
City*
State*
ZIP Code*
ATM/Visa Check Card Number*
Expiration Date*
-- ▾ ---- ▾
Card Verification Number*
PIN*

*Denotes required field

Need help? Use Site Helper or call eCare® customer service at 1.800.788.7000.

FDIC Insured
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Personal Banking | Small Business Banking | Commercial Banking
Home Loans | Investments | Insurance | About WaMu
Online Services Agreement & Disclosure | Terms of Use | Your Privacy & Security

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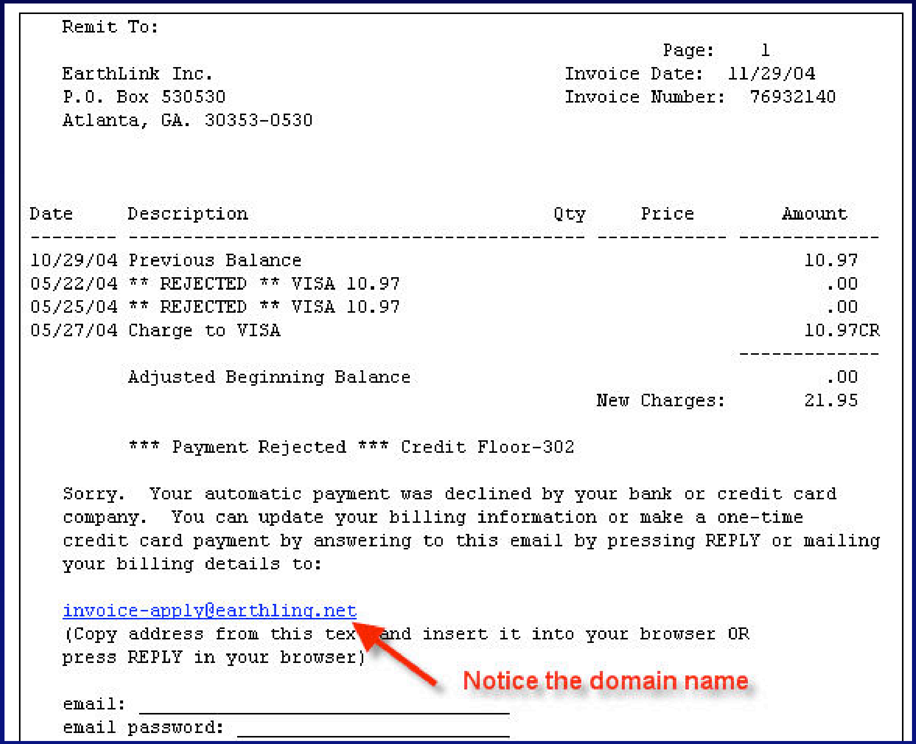
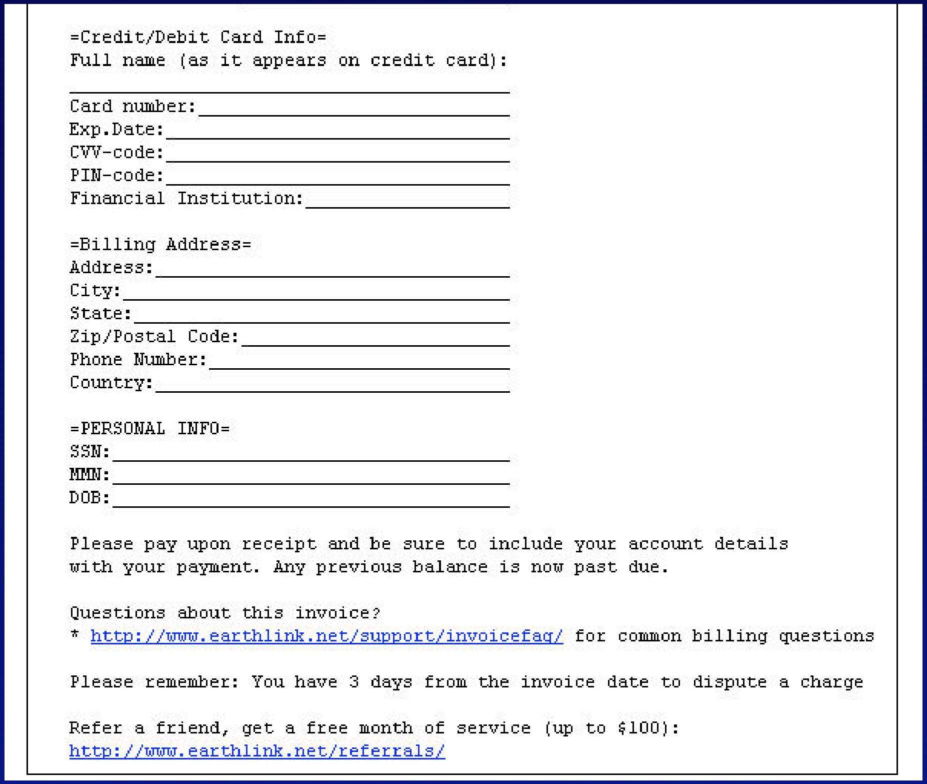
Finally user is redirected to real "wamu.com" site

# Example 2: text message claims problem with Earthlink payment… User fills in form and emails to "invoice-apply@earthling.net"



```
    Remit To:
                                                       Page:    1
    EarthLink Inc.                               Invoice Date:  11/29/04
    P.O. Box 530530                              Invoice Number:  76932140
    Atlanta, GA. 30353-0530


Date     Description                                 Qty     Price         Amount
-------- ------------------------------------------ ------------ -------------
10/29/04 Previous Balance                                                  10.97
05/22/04 ** REJECTED ** VISA 10.97                                           .00
05/25/04 ** REJECTED ** VISA 10.97                                           .00
05/27/04 Charge to VISA                                                  10.97CR
                                                                   -------------
         Adjusted Beginning Balance                                          .00
                                                   New Charges:            21.95

         *** Payment Rejected *** Credit Floor-302

    Sorry.  Your automatic payment was declined by your bank or credit card
    company.  You can update your billing information or make a one-time
    credit card payment by answering to this email by pressing REPLY or mailing
    your billing details to:

    invoice-apply@earthling.net
    (Copy address from this text and insert it into your browser OR
    press REPLY in your browser)

    email: _________________________________
    email password: _________________________
```

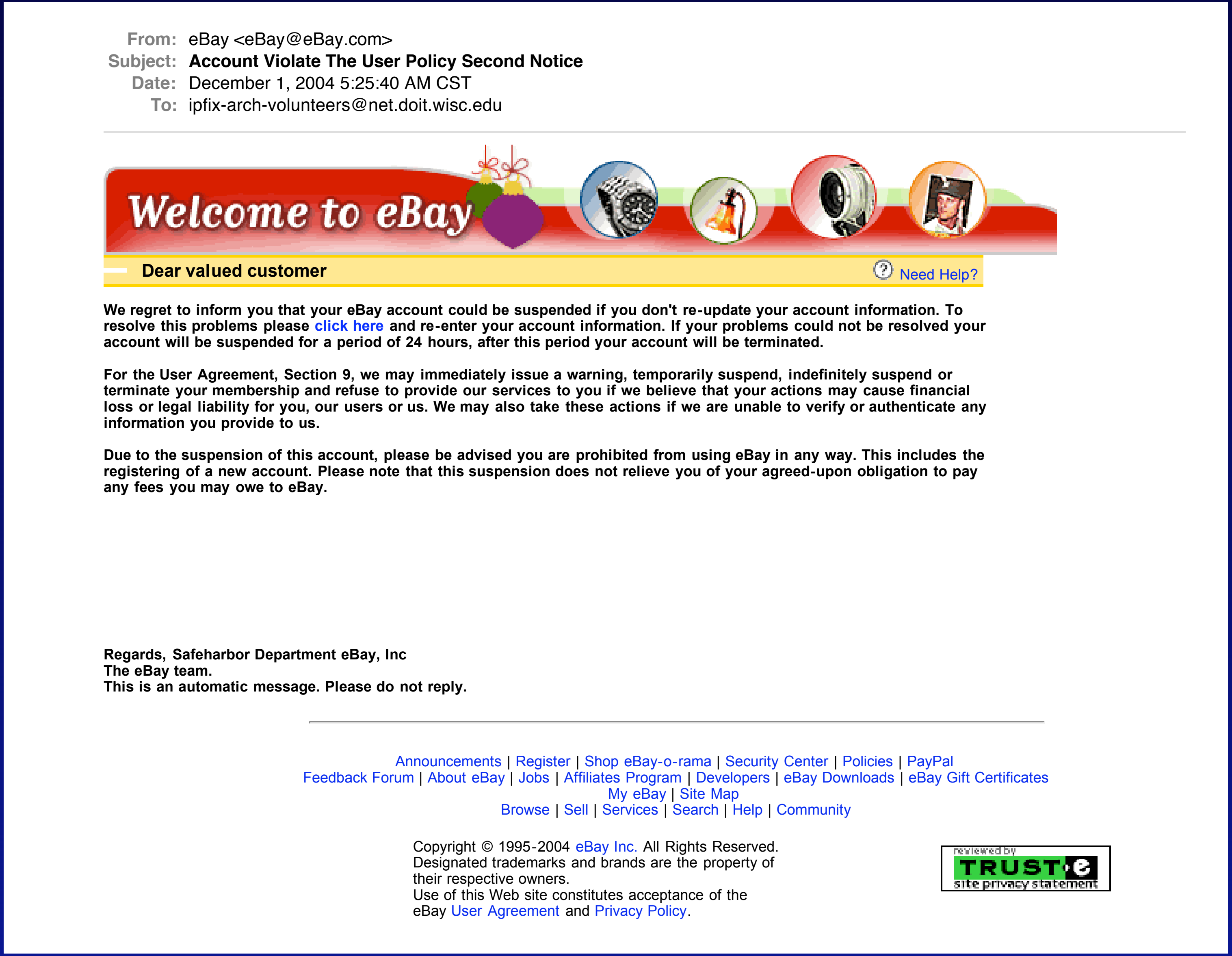
Notice the domain name



```
=Credit/Debit Card Info=
Full name (as it appears on credit card):
_________________________________________
Card number:_____________________________
Exp.Date:________________________________
CVV-code:________________________________
PIN-code:________________________________
Financial Institution:___________________

=Billing Address=
Address:_________________________________
City:____________________________________
State:___________________________________
Zip/Postal Code:_________________________
Phone Number:____________________________
Country:_________________________________

=PERSONAL INFO=
SSN:_____________________________________
MMN:_____________________________________
DOB:_____________________________________

Please pay upon receipt and be sure to include your account details
with your payment. Any previous balance is now past due.

Questions about this invoice?
* http://www.earthlink.net/support/invoicefaq/ for common billing questions

Please remember: You have 3 days from the invoice date to dispute a charge

Refer a friend, get a free month of service (up to $100):
http://www.earthlink.net/referrals/
```

No fake Website used in this case

# Example 3: email asks for confirmation of eBay account or account will be suspended



From: eBay <eBay@eBay.com>
Subject: **Account Violate The User Policy Second Notice**
Date: December 1, 2004 5:25:40 AM CST
To: ipfix-arch-volunteers@net.doit.wisc.edu

**Dear valued customer** ? Need Help?

**We regret to inform you that your eBay account could be suspended if you don't re-update your account information. To resolve this problems please click here and re-enter your account information. If your problems could not be resolved your account will be suspended for a period of 24 hours, after this period your account will be terminated.**

**For the User Agreement, Section 9, we may immediately issue a warning, temporarily suspend, indefinitely suspend or terminate your membership and refuse to provide our services to you if we believe that your actions may cause financial loss or legal liability for you, our users or us. We may also take these actions if we are unable to verify or authenticate any information you provide to us.**

**Due to the suspension of this account, please be advised you are prohibited from using eBay in any way. This includes the registering of a new account. Please note that this suspension does not relieve you of your agreed-upon obligation to pay any fees you may owe to eBay.**

**Regards, Safeharbor Department eBay, Inc**
**The eBay team.**
**This is an automatic message. Please do not reply.**

Announcements | Register | Shop eBay-o-rama | Security Center | Policies | PayPal
Feedback Forum | About eBay | Jobs | Affiliates Program | Developers | eBay Downloads | eBay Gift Certificates
My eBay | Site Map
Browse | Sell | Services | Search | Help | Community

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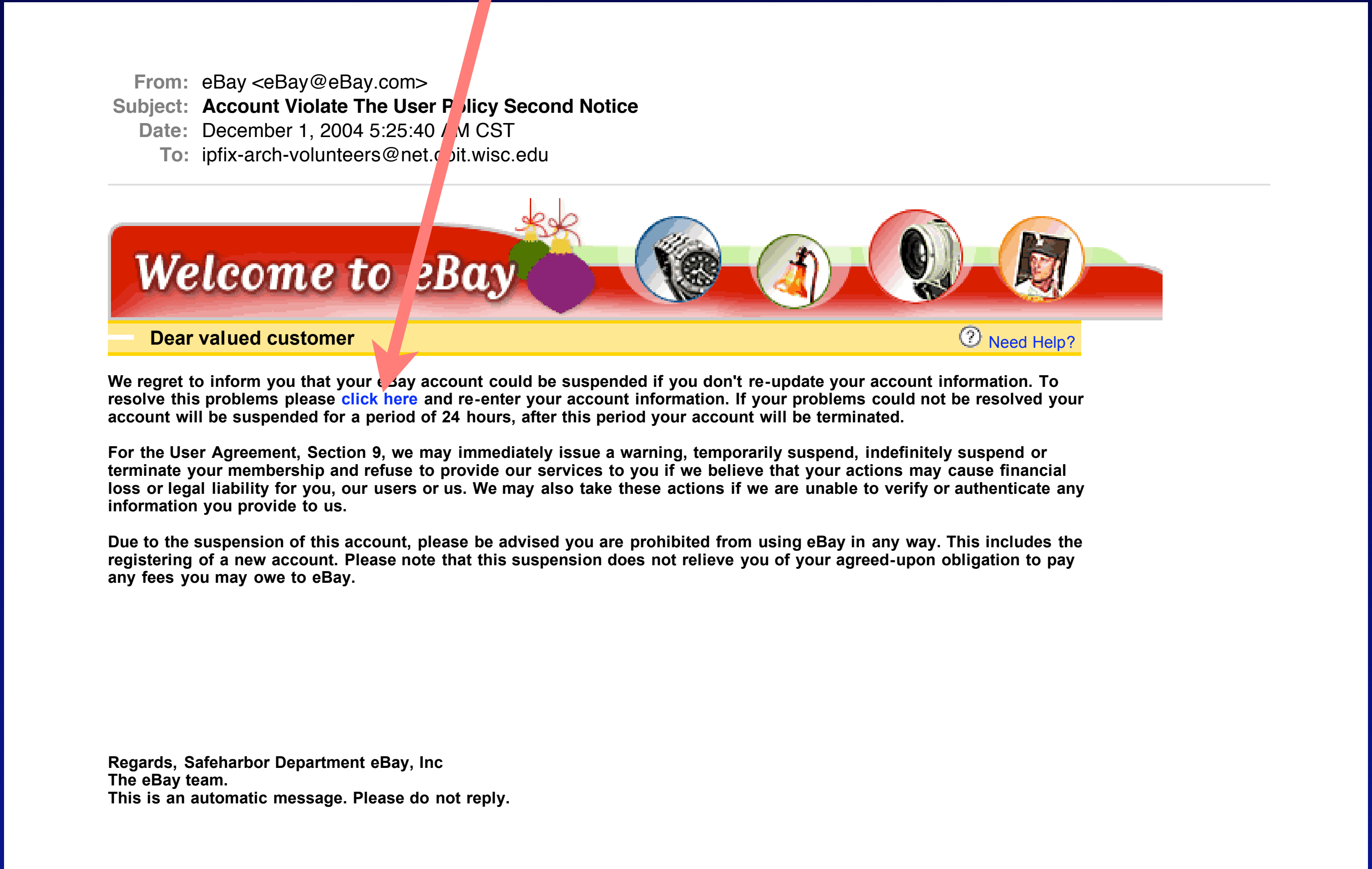
Use of this Web site constitutes acceptance of the eBay User Agreement and Privacy Policy.

# Link calls "cgi3.ebay.com.wws2.us/update/aw-cgi/eBayISAPI.dll/index.html" intentionally similar to real eBay URL



**From:** eBay <eBay@eBay.com>
**Subject:** **Account Violate The User Policy Second Notice**
**Date:** December 1, 2004 5:25:40 AM CST
**To:** ipfix-arch-volunteers@net.doit.wisc.edu

**Dear valued customer**

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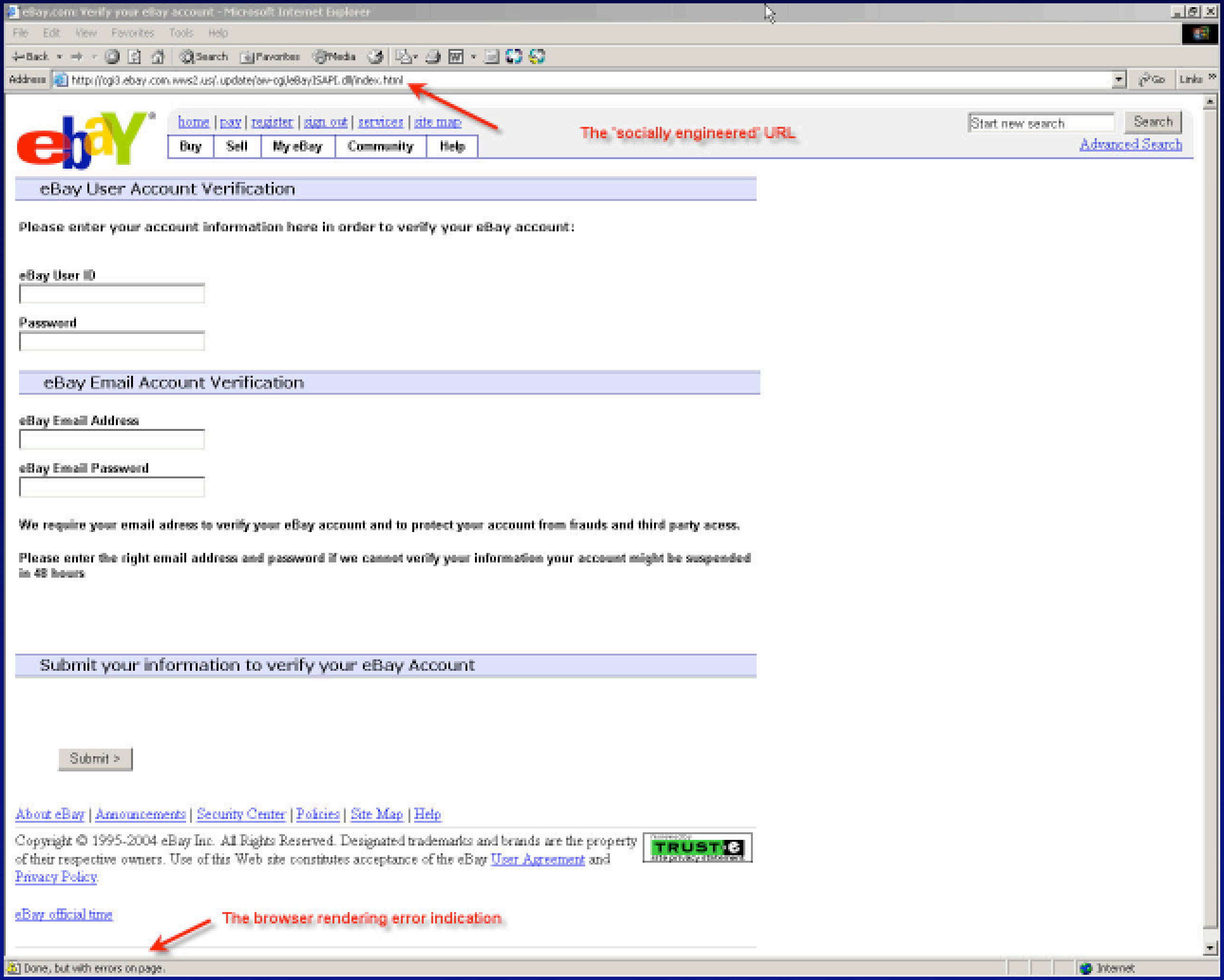
For the User Agreement, Section 9, we may immediately issue a warning, temporarily suspend, indefinitely suspend or terminate your membership and refuse to provide our services to you if we believe that your actions may cause financial loss or legal liability for you, our users or us. We may also take these actions if we are unable to verify or authenticate any information you provide to us.

Due to the suspension of this account, please be advised you are prohibited from using eBay in any way. This includes the registering of a new account. Please note that this suspension does not relieve you of your agreed-upon obligation to pay any fees you may owe to eBay.

Regards, Safeharbor Department eBay, Inc
The eBay team.
This is an automatic message. Please do not reply.

# Clues: fake Website looks real except not exact URL



eBay.com: Verify your eBay account - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://cgi3.ebay.com.ww2.us/.update/aw-cgi/eBayISAPI.dll/index.html
Go Links
home | pay | register | sign out | services | site map
Buy
Sell
My eBay
Community
Help
Start new search
Search
Advanced Search

The "socially engineered" URL

## eBay User Account Verification

Please enter your account information here in order to verify your eBay account:

eBay User ID

Password

## eBay Email Account Verification

eBay Email Address

eBay Email Password

We require your email adress to verify your eBay account and to protect your account from frauds and third party acess.

Please enter the right email address and password if we cannot verify your information your account might be suspended in 48 hours

## Submit your information to verify your eBay Account

Submit >
About eBay | Announcements | Security Center | Policies | Site Map | Help

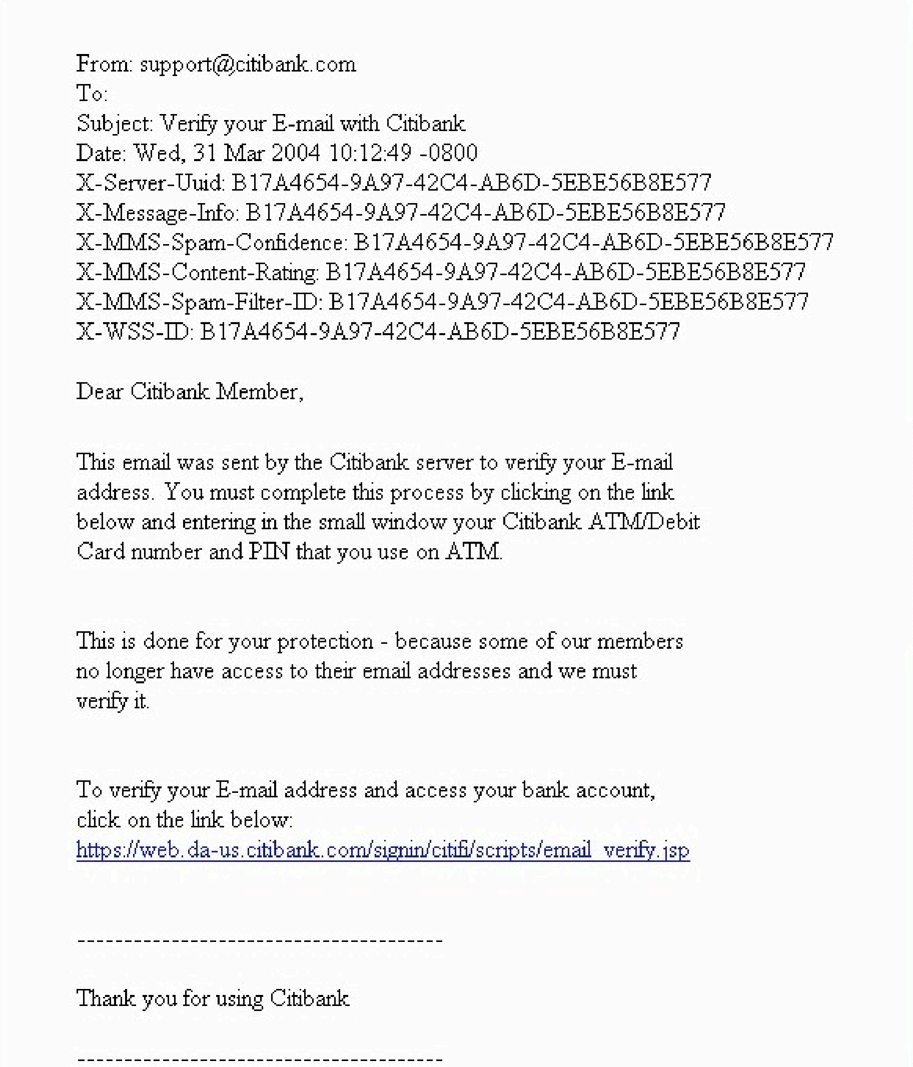
Copyright © 1995-2004 eBay Inc. All Rights Reserved. Designated trademarks and brands are the property of their respective owners. Use of this Web site constitutes acceptance of the eBay User Agreement and Privacy Policy.

The browser rendering error indication

Done, but with errors on page.

# IE shows rendering errors

# Example 4: generic, plain email asks to verify Citibank account info.



From: support@citibank.com
To:
Subject: Verify your E-mail with Citibank
Date: Wed, 31 Mar 2004 10:12:49 -0800
X-Server-Uuid: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-Message-Info: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-MMS-Spam-Confidence: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-MMS-Content-Rating: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-MMS-Spam-Filter-ID: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-WSS-ID: B17A4654-9A97-42C4-AB6D-5EBE56B8E577

Dear Citibank Member,

This email was sent by the Citibank server to verify your E-mail address. You must complete this process by clicking on the link below and entering in the small window your Citibank ATM/Debit Card number and PIN that you use on ATM.

This is done for your protection - because some of our members no longer have access to their email addresses and we must verify it.

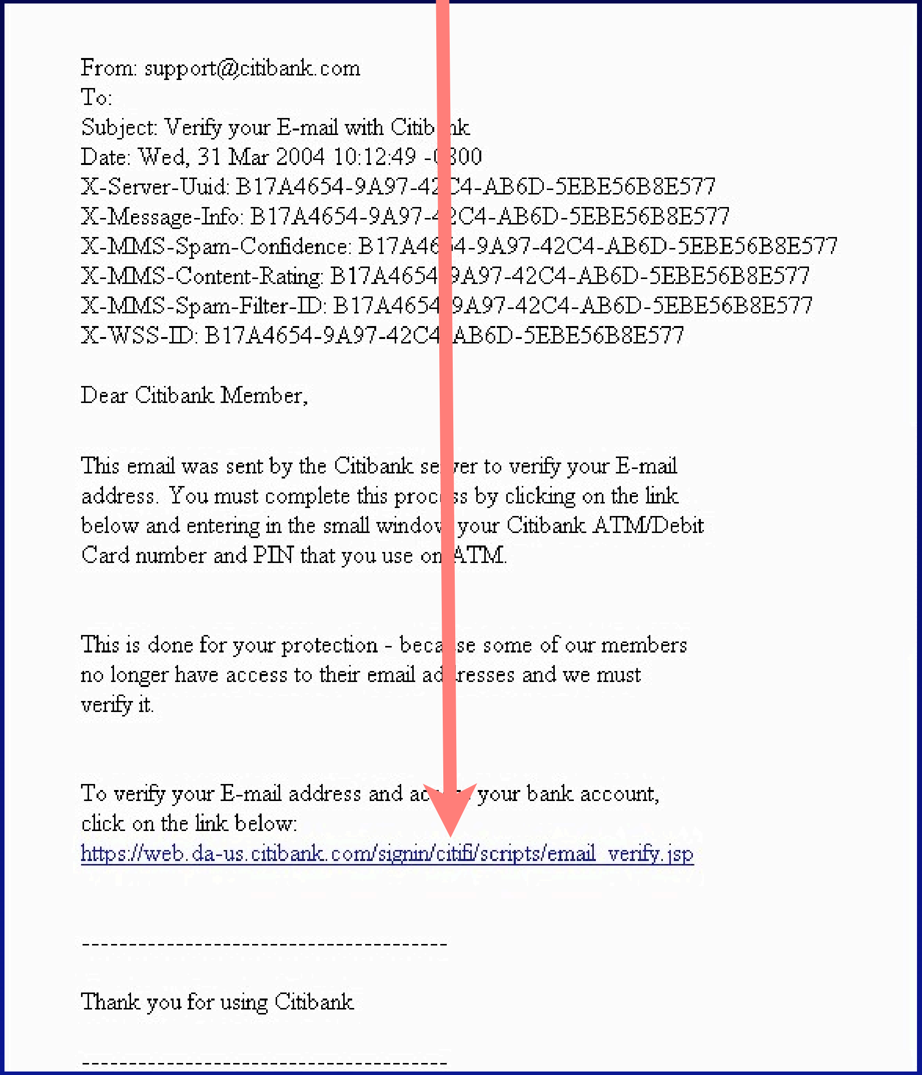
To verify your E-mail address and access your bank account, click on the link below:
https://web.da-us.citibank.com/signin/citifi/scripts/email_verify.jsp

----------------------------------------

Thank you for using Citibank

----------------------------------------

# Link to "https://web.da-us.citibank.com/signin/citifi/scripts/email_verify.jsp" actually goes to IP address 69.65.202.82 (registered to ThePlanet Internet Services)



From: support@citibank.com
To:
Subject: Verify your E-mail with Citibank
Date: Wed, 31 Mar 2004 10:12:49 -0800
X-Server-Uuid: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-Message-Info: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-MMS-Spam-Confidence: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-MMS-Content-Rating: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-MMS-Spam-Filter-ID: B17A4654-9A97-42C4-AB6D-5EBE56B8E577
X-WSS-ID: B17A4654-9A97-42C4-AB6D-5EBE56B8E577

Dear Citibank Member,

This email was sent by the Citibank server to verify your E-mail address. You must complete this process by clicking on the link below and entering in the small window your Citibank ATM/Debit Card number and PIN that you use on ATM.

This is done for your protection - because some of our members no longer have access to their email addresses and we must verify it.

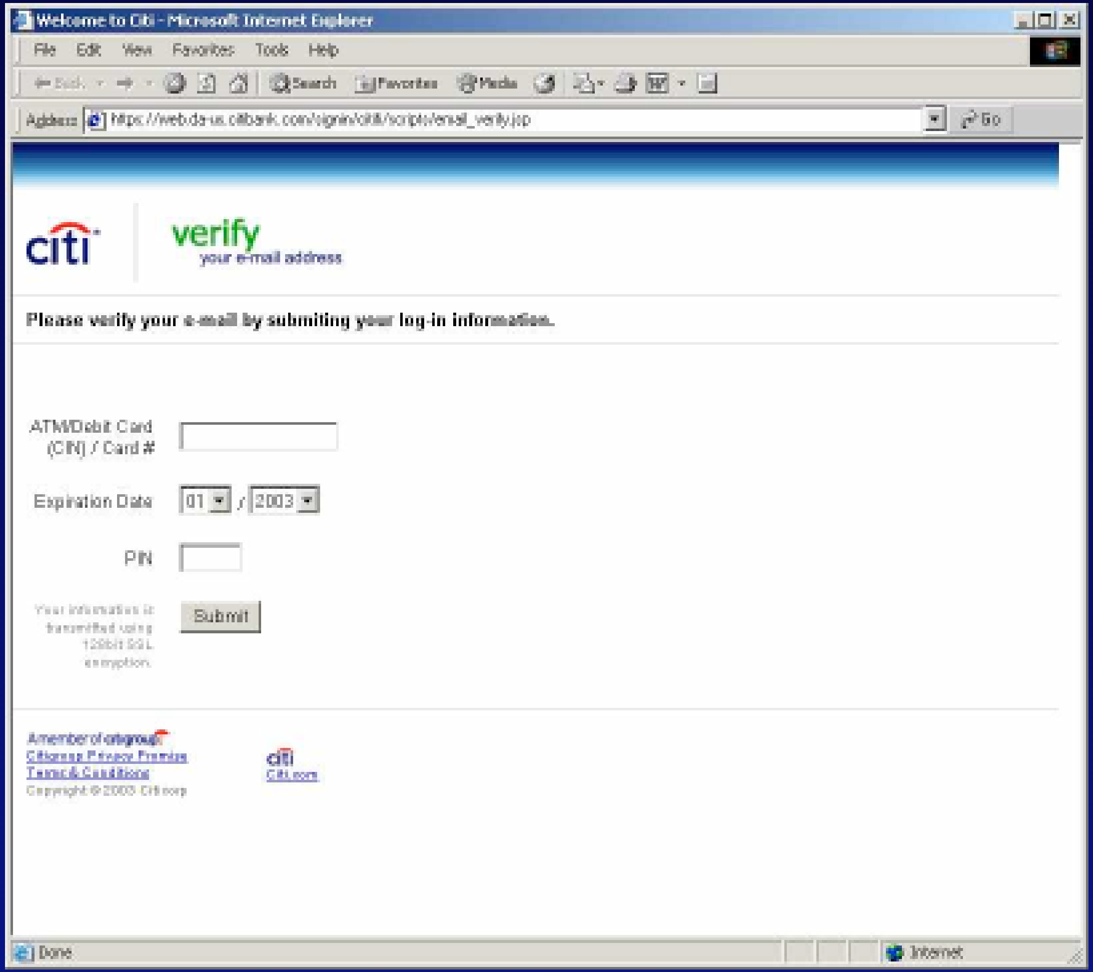
To verify your E-mail address and access your bank account, click on the link below:
https://web.da-us.citibank.com/signin/citifi/scripts/email_verify.jsp

----------------------------------------

Thank you for using Citibank

----------------------------------------

# Address bar shows "https://web.da-us.citibank.com/signin/citifi/scripts/email_verify.jsp"


Welcome to Citi - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address
Go
citi
Done
Internet

Address: https://web.da-us.citibank.com/signin/citifi/scripts/email_verify.jsp

verify
your e-mail address

Please verify your e-mail by submitting your log-in information.

|  |  |
|---|---|
| ATM/Debit Card (CIN) / Card # |  |
| Expiration Date | 01 / 2003 |
| PIN |  |
| Your information is transmitted using 128bit SSL encryption. | Submit |

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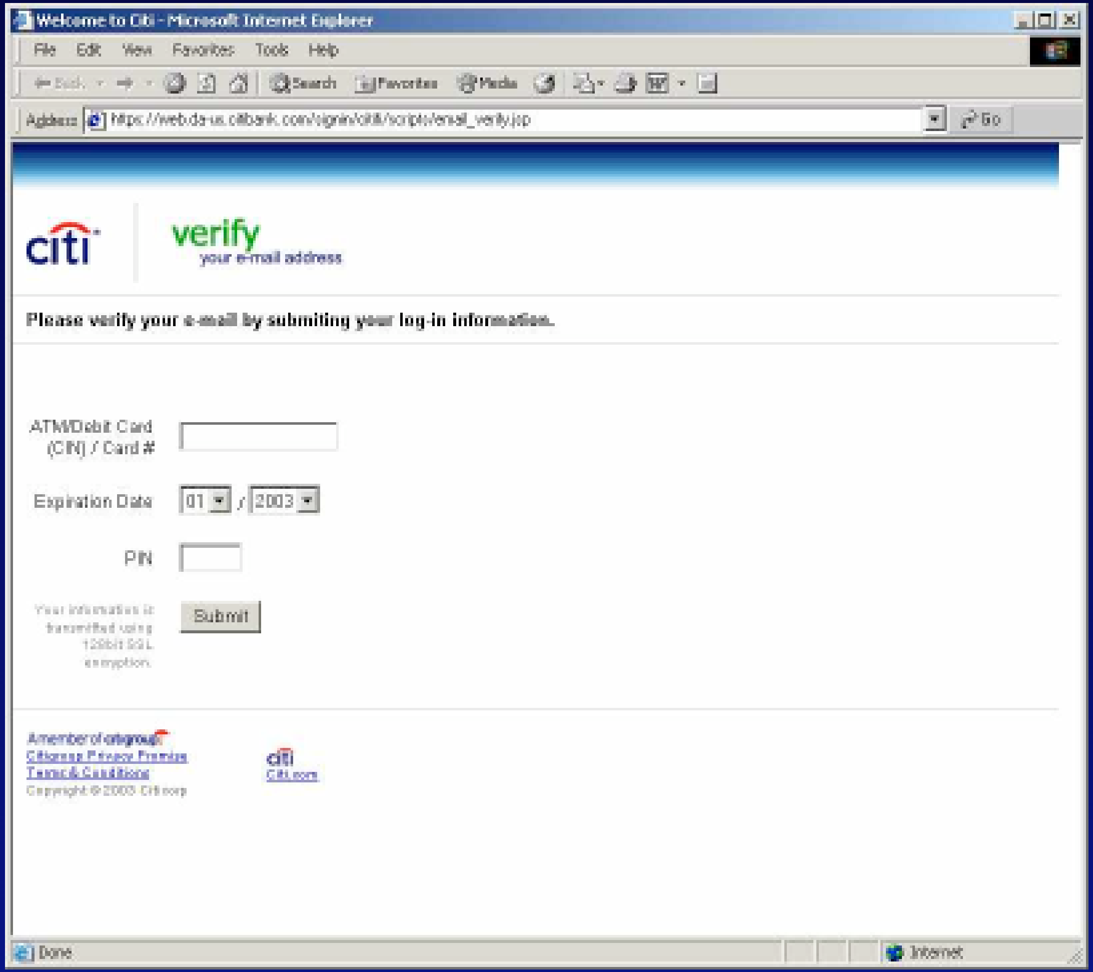
Terms & Conditions
Copyright © 2003 Citicorp

Citi.com

But real address bar is actually covered by a fake address bar graphic using Javascript and frames

# Clue: "https://web.da-us.citibank.com/signin/citifi/scripts/email_verify.jsp" should be secure HTTP



https://web.da-us.citibank.com/signin/citifi/scripts/email_verify.jsp

citi

verify
your e-mail address

**Please verify your e-mail by submiting your log-in information.**

ATM/Debit Card (CIN) / Card #

Expiration Date 01 / 2003

PIN

Your information is transmitted using 128bit SSL encryption.

Submit

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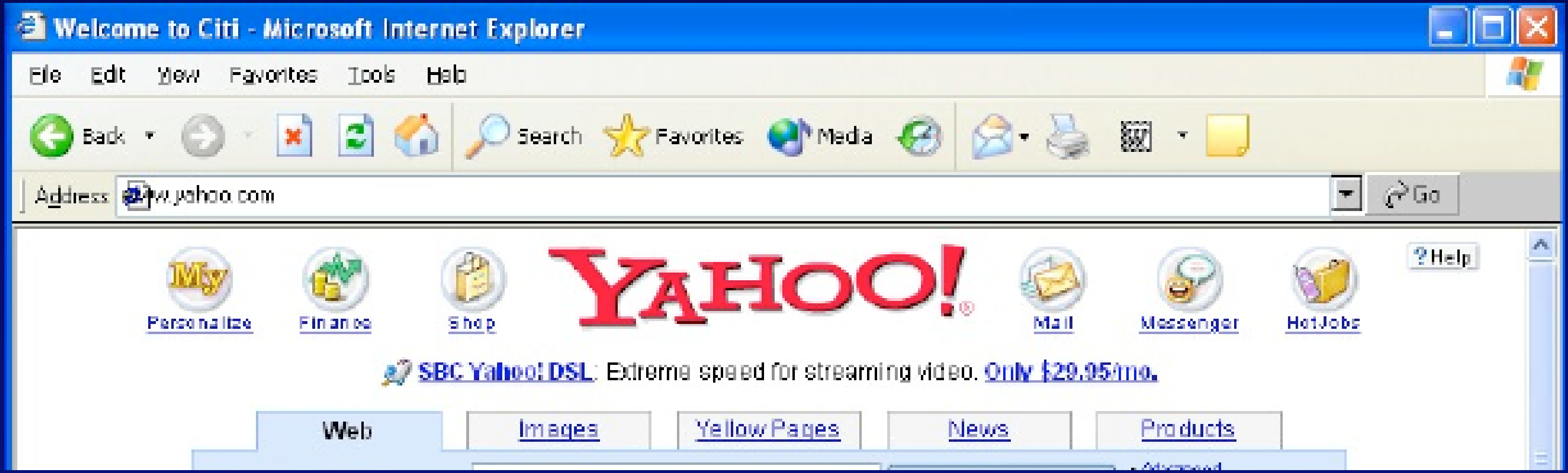
Terms & Conditions
Copyright © 2003 Citicorp

citi
Citi.com

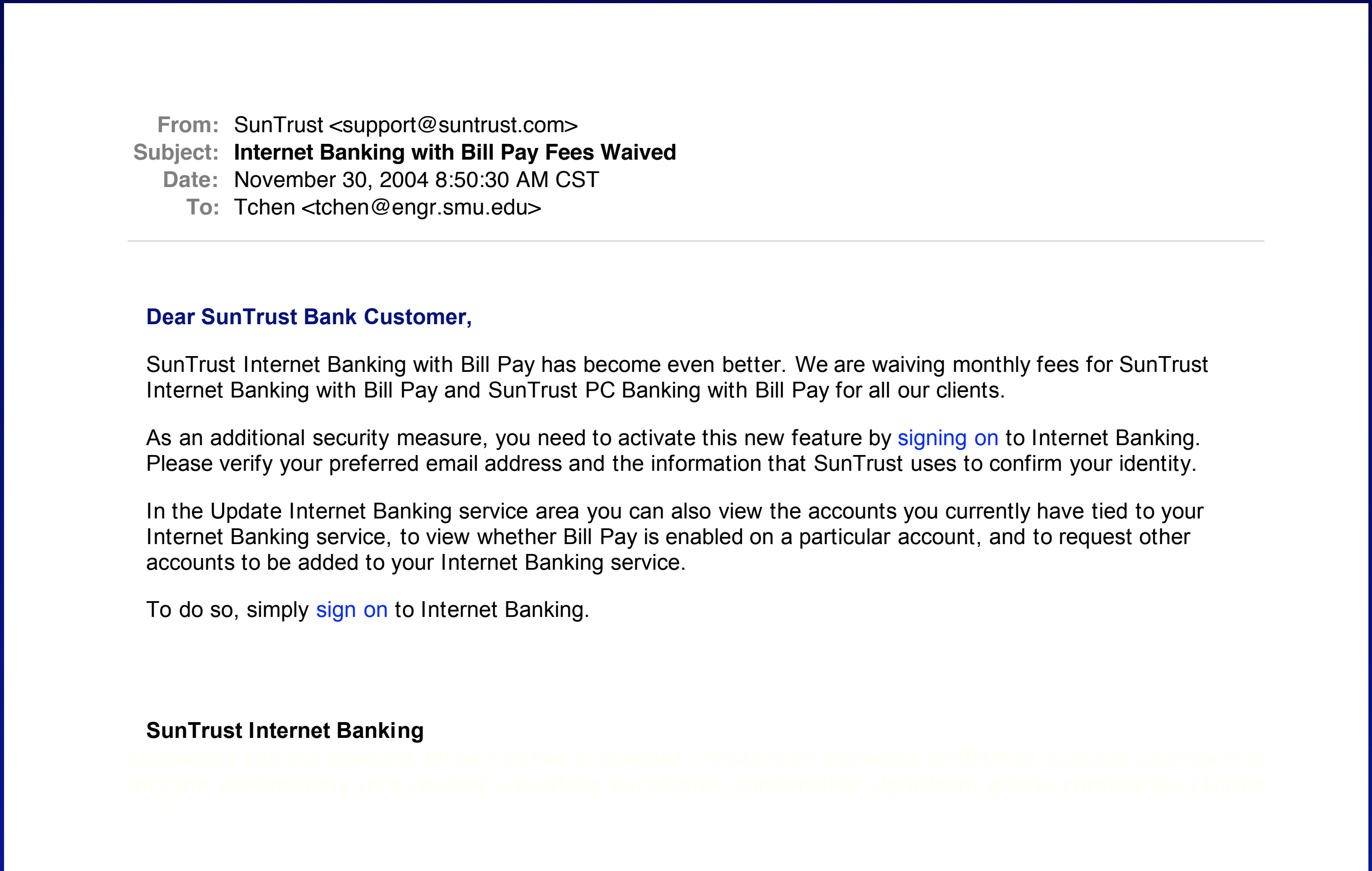
But browser does not show padlock icon at bottom

# Clue: going to another URL (Yahoo) still shows top frame that says "Welcome to Citi"



Welcome to Citi - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Media
Address
www.yahoo.com
Go
Personalize
Finance
Shop
YAHOO!
Mail
Messenger
HotJobs
? Help
SBC Yahoo! DSL: Extreme speed for streaming video. Only $29.95/mo.
Web
Images
Yellow Pages
News
Products

# Example 5: email from SunTrust Bank promotes fee waiver but feature must be activated at Website



From: SunTrust <support@suntrust.com>
Subject: **Internet Banking with Bill Pay Fees Waived**
Date: November 30, 2004 8:50:30 AM CST
To: Tchen <tchen@engr.smu.edu>

**Dear SunTrust Bank Customer,**

SunTrust Internet Banking with Bill Pay has become even better. We are waiving monthly fees for SunTrust Internet Banking with Bill Pay and SunTrust PC Banking with Bill Pay for all our clients.

As an additional security measure, you need to activate this new feature by signing on to Internet Banking. Please verify your preferred email address and the information that SunTrust uses to confirm your identity.

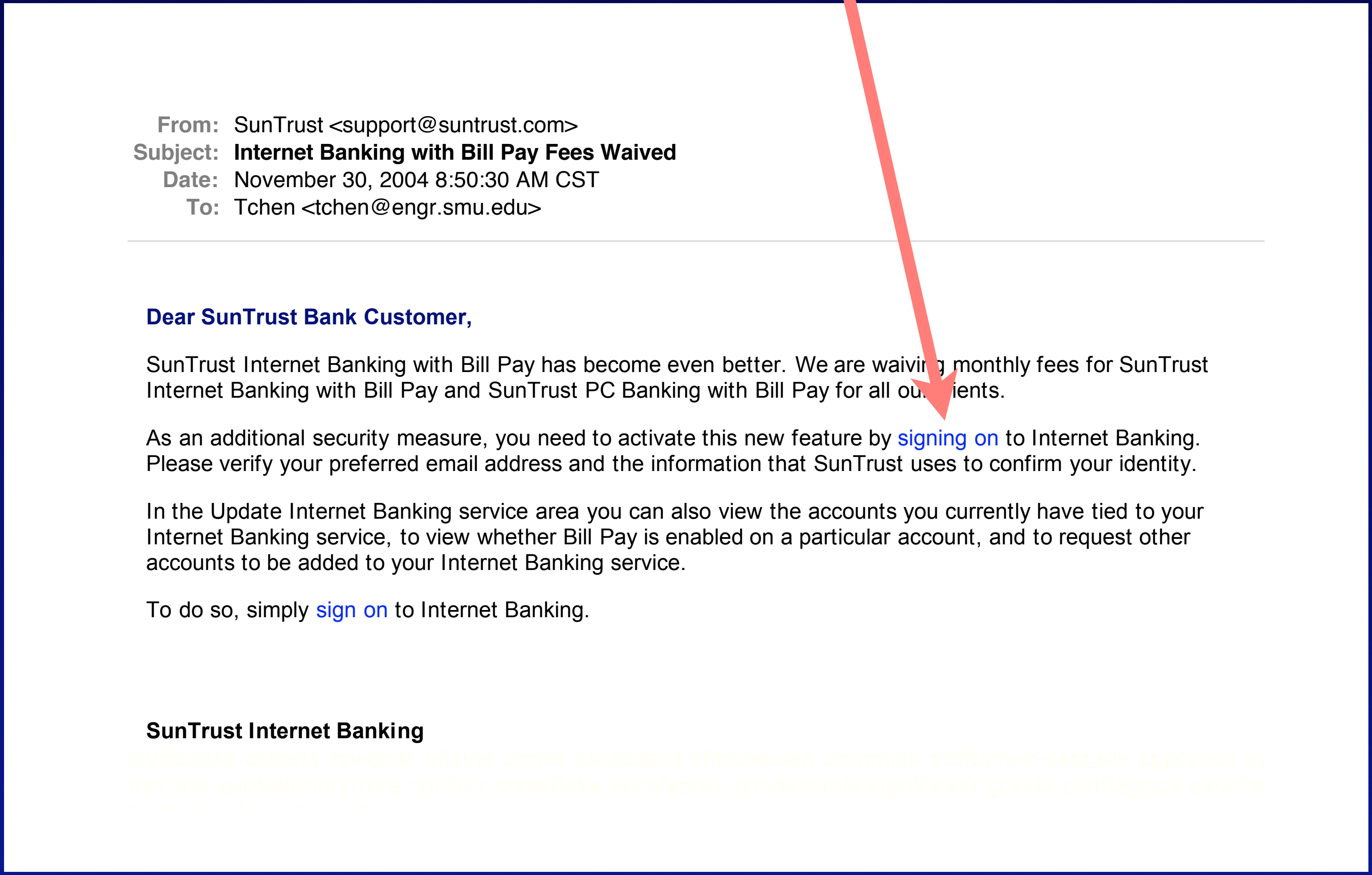
In the Update Internet Banking service area you can also view the accounts you currently have tied to your Internet Banking service, to view whether Bill Pay is enabled on a particular account, and to request other accounts to be added to your Internet Banking service.

To do so, simply sign on to Internet Banking.

**SunTrust Internet Banking**

clubhouse cabana towboat bilayer donor ascendant christenson dominick draftsmen cascade approach va
mccann evolutionary tore confect snowflake eucalyptus condensible significant gouda conflagrate clearhe

# Link calls “www.people-online.net” at IP address 196.40.75.39 (in Costa Rica)



From: SunTrust <support@suntrust.com>
Subject: **Internet Banking with Bill Pay Fees Waived**
Date: November 30, 2004 8:50:30 AM CST
To: Tchen <tchen@engr.smu.edu>

**Dear SunTrust Bank Customer,**

SunTrust Internet Banking with Bill Pay has become even better. We are waiving monthly fees for SunTrust Internet Banking with Bill Pay and SunTrust PC Banking with Bill Pay for all our clients.

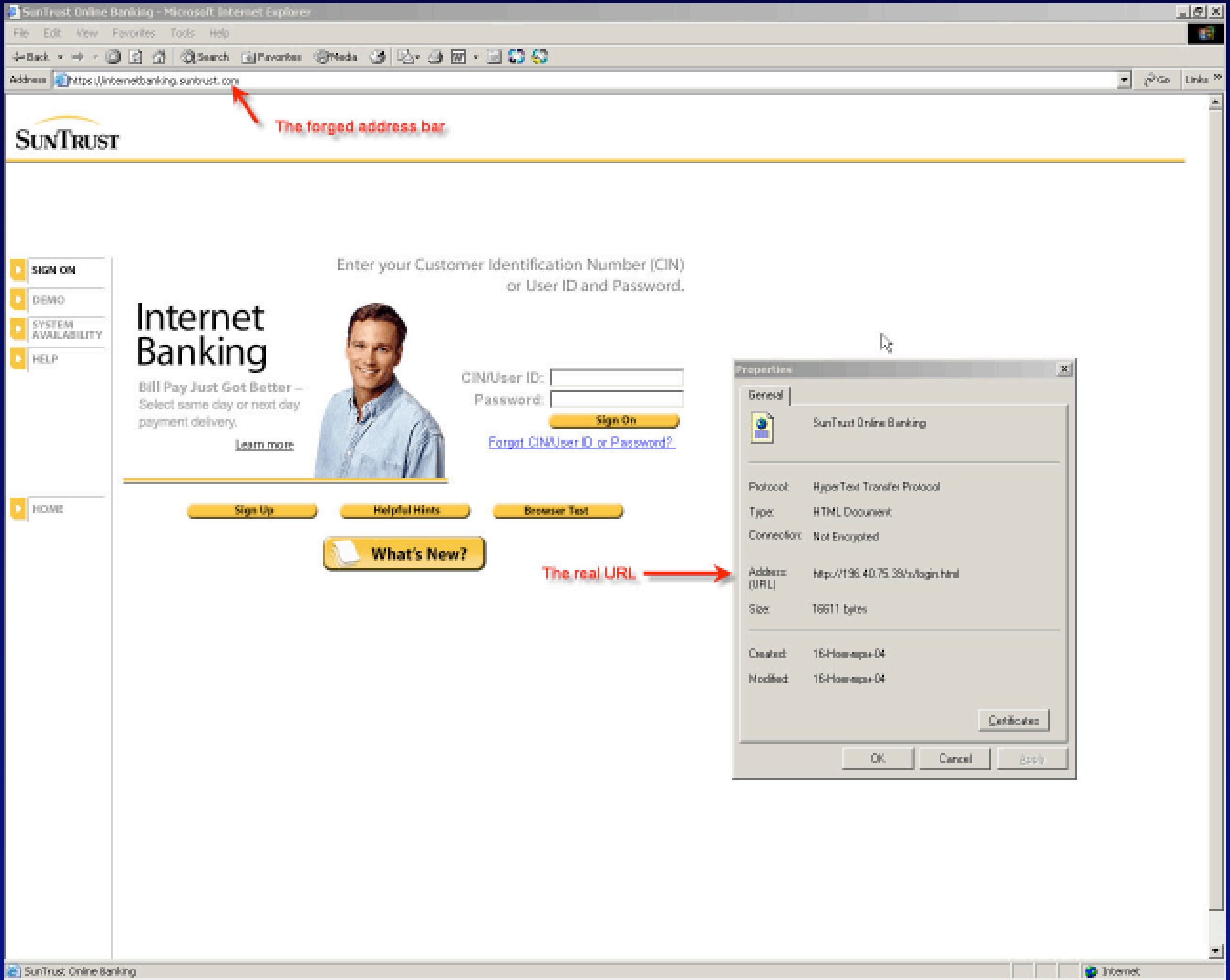
As an additional security measure, you need to activate this new feature by signing on to Internet Banking. Please verify your preferred email address and the information that SunTrust uses to confirm your identity.

In the Update Internet Banking service area you can also view the accounts you currently have tied to your Internet Banking service, to view whether Bill Pay is enabled on a particular account, and to request other accounts to be added to your Internet Banking service.

To do so, simply sign on to Internet Banking.

**SunTrust Internet Banking**

# Clues: forged IE address bar shows “https://internetbanking.suntrust.com”



Address: https://internetbanking.suntrust.com

The forged address bar

Enter your Customer Identification Number (CIN) or User ID and Password.

Internet Banking

Bill Pay Just Got Better – Select same day or next day payment delivery.

Learn more

CIN/User ID:

Password:

Forgot CIN/User ID or Password?

The real URL

Properties

SunTrust Online Banking

Protocol: HyperText Transfer Protocol

Type: HTML Document

Connection: Not Encrypted

Address (URL): http://196.40.75.39/s/login.html

Size: 16611 bytes

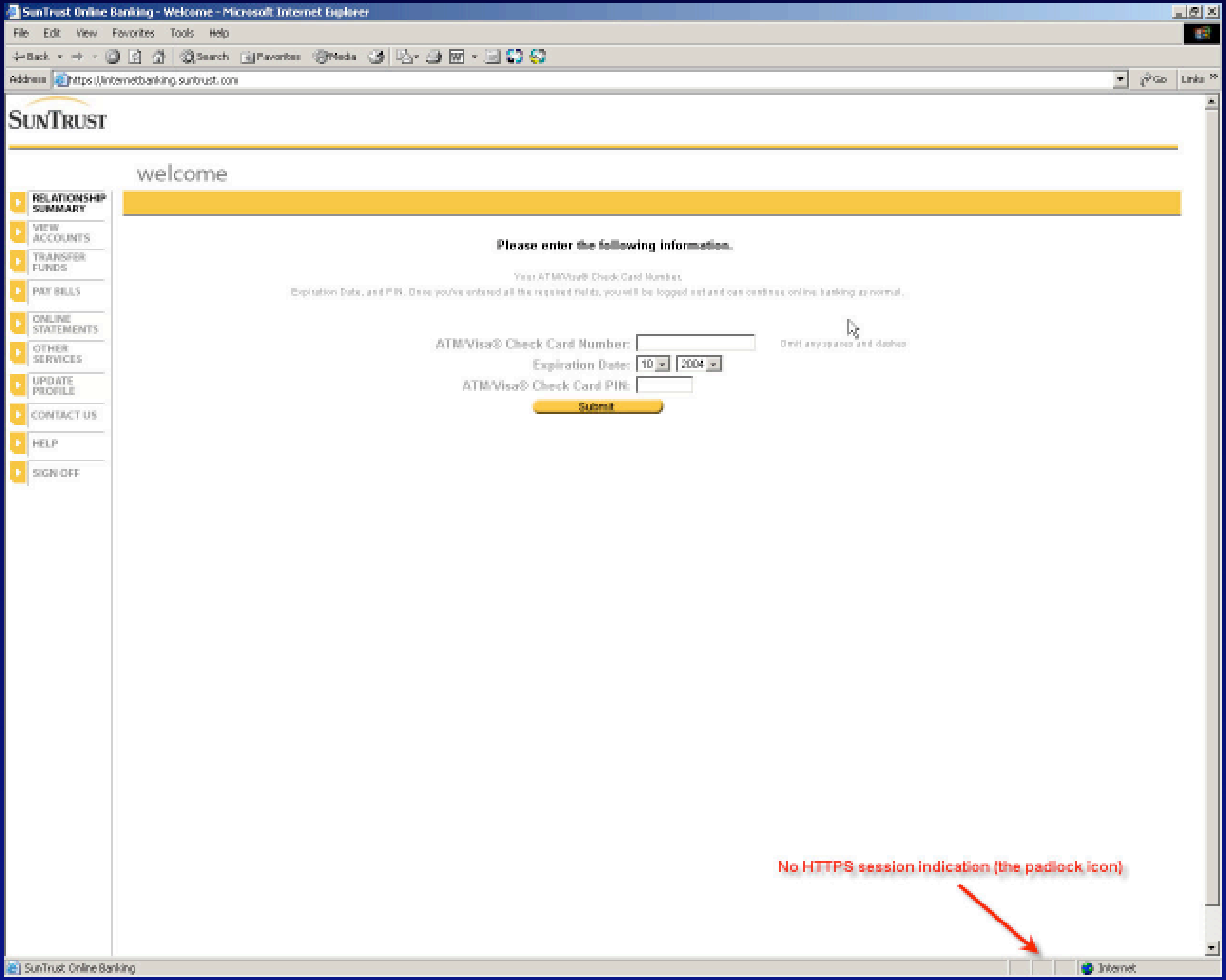
Created: 16-Ноември-04

Modified: 16-Ноември-04

SunTrust Online Banking

# Properties page show real URL is “http://196.40.75.39/s/login.html”

# After user logs in, Website asks for ATM/Visa check card info



Please enter the following information.

Your ATM/Visa® Check Card Number, Expiration Date, and PIN. Once you've entered all the required fields, you will be logged out and can continue online banking as normal.

ATM/Visa® Check Card Number: Omit any spaces and dashes

Expiration Date: 10 2004

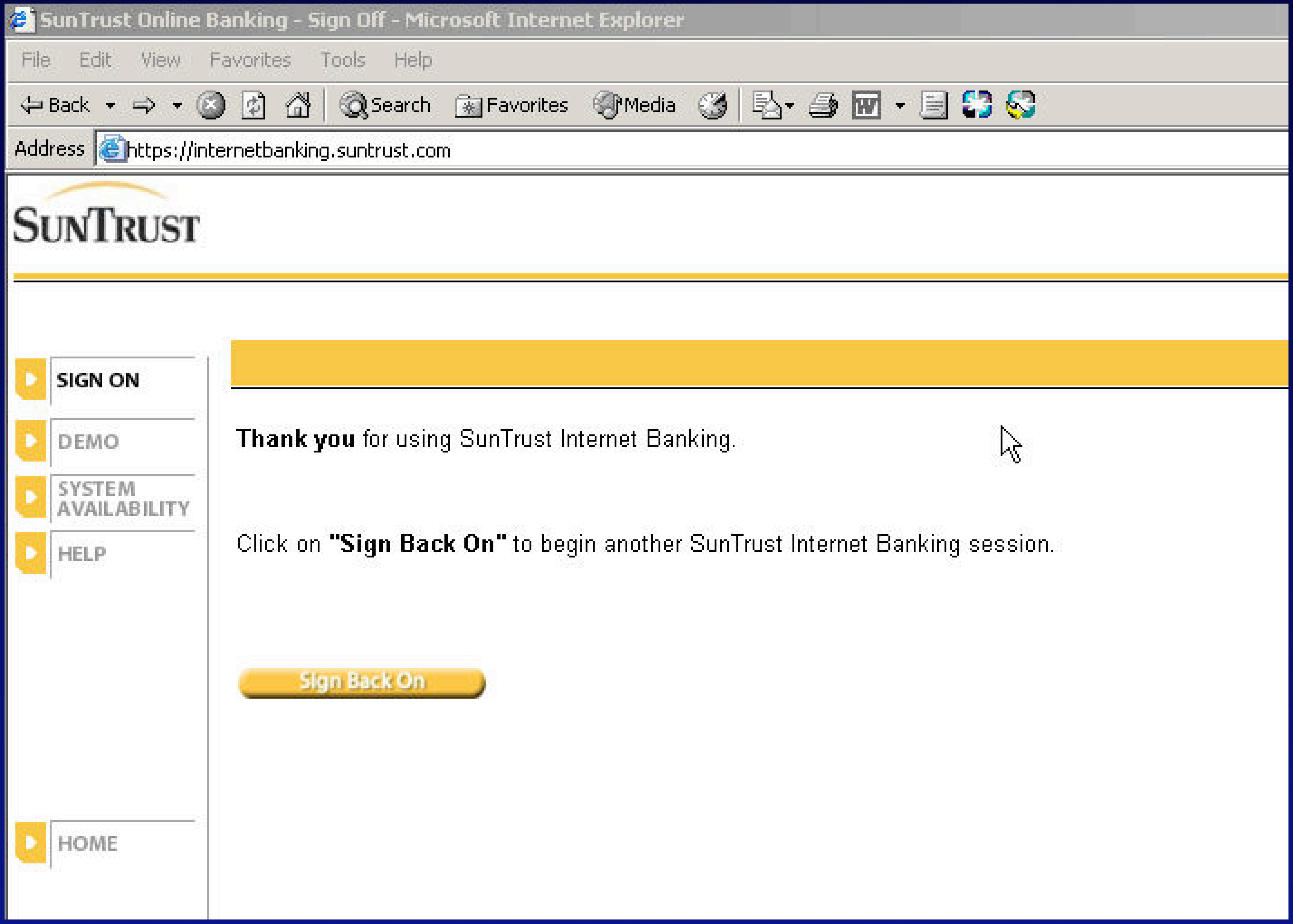
ATM/Visa® Check Card PIN:

Submit

No HTTPS session indication (the padlock icon)

# IE status bar does not show secure HTTP session

# Final "log-out" page...



SunTrust Online Banking - Sign Off - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://internetbanking.suntrust.com
SUNTRUST
SIGN ON
DEMO
SYSTEM AVAILABILITY
HELP
HOME
Sign Back On

**Thank you** for using SunTrust Internet Banking.

Click on **"Sign Back On"** to begin another SunTrust Internet Banking session.

Finally user is redirected to real "suntrust.com" site

# Statistics

- $ 1.2 billion damages to US financial organizations so far
- In US, 57 million consumers have received phishing email
  - 1.8 million consumers believe tricked (3% rate)
- Phishing sites are hosted mostly in US (29%), China (16%), Korea (9%), Russia (8%), others

# October 2004 Statistics

- 6,597 new unique phishing messages and 1,142 active phishing Web sites detected
- 25% monthly increase in phishing Websites
- Phishing Website is online for 6.4 days on average
- 44 brands hijacked (banks, credit card companies, retailers,...)

# Motivations

- Easy profits:
  - Phishing emails (like spam) are low cost to hit millions of people
  - Social engineering attack is low tech and easy to craft
  - Easy to register and set up phishing Web sites (and move later)
  - Even low success rate (3% or perhaps higher) can be very profitable

# Motivations (cont)

- Low risk
  - Pfishing email often sent through compromised “zombies” or open relays -- hard to trace
  - Pfishing Websites are registered with phony info and moved around frequently to different IP addresses

# Threats

- Identity theft
  - Stolen bank accounts and passwords/PINs
  - Stolen social security numbers, addresses
  - Stolen credit card numbers
- Download spyware to victim PC to eavesdrop
- Infect victim with virus

# Defenses

- User education and awareness
- Commercial products and services
  - Spamtraps
  - Managed email services
  - Fraud detection
  - Browser toolbars

# User Awareness

- Users should look for telltale signs of phishing email
  - Lack of personalization, suspicious URLs, attachments, random or misspelled words, bad grammar, urgent tone
- Users should type URLs in browser, stay with known Websites, do not open attachments, check for known scams

# User Awareness (cont)

- But phishers have many tricks to fool even cautious users
  - HTML email can look like plain text and hide Javascript or invisible content
  - Similar URLs can be easily crafted by “1” instead of “l”, or “0” instead of “O”
  - Similar domain names can be registered
    - “mybank.com” could be confused with “mybank.com.us” or “mybank.fake.com”

# User Awareness (cont)

- Many tricks (cont)
  - Host name obfuscation, eg, "http://mybank.com:login@210.10.3.5/index.htm" actually goes to IP address 210.10.3.5, not mybank.com
  - HTML allows graphics or complete pages to cover underlying pages
- Increasing user awareness will not be effective solution

# Spamtraps

- Spamtraps (e-mail honeypots) are computers loaded with fake email accounts
  - Fake email accounts are not used for legitimate purposes
  - Virtually all email to spamtraps is spam
  - Spam is analyzed manually and automatically for phishing attacks
  - Links are analyzed by phishing Websites

# Websense

- Websense Security Labs mines and analyzes over 24 million Websites daily
- Operates global honeynet (network of honeypots) to discover new attacks
- Software for client companies to automatically report suspicious Websites for analysis
- Classifies and reports threats to clients

# Webwasher

- Operates honeypots to collect spam and analyze new phishing attacks
- Maintains database of known fraudulent sites
- Webwasher URL Filter blocks known fraudulent sites
- Webwasher AntiSpam filters e-mail for spam

# NameProtect

- Working with MasterCard to detect phishing attacks in real time
- Continually monitors Websites, domain names, spam e-mail, to detect trademark or copyright infringement and fraudulent sites

# Cyota

- FraudAction analyzes data from various probes, honeypots, partners, to detect new phishing attacks
- Analysts create risk assessment reports for each attack
- Send alerts to client banks

# MarkMonitor

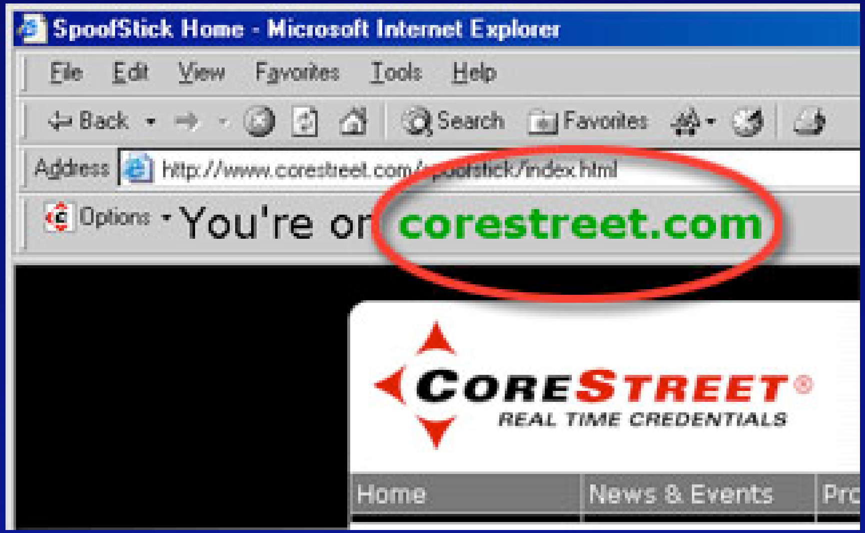
- Fraud Protection service analyzes data from honeypots to identify new attacks
- Monitors chat rooms, newsgroups, domain registries
- Correlates data to identify potential threats
- Alerts clients about high risk threats to corporate brands

# WebRoot Phish Net

- Phish Net encrypts personal data on PC and alerts user if transmitting personal info
- WebRoot also keeps blacklist of known fraudulent sites, compares to visited Website

# CoreStreet SpoofStick

- Toolbar prominently identifies real URL of visited Website
- Will not detect popups covering a legitimate site



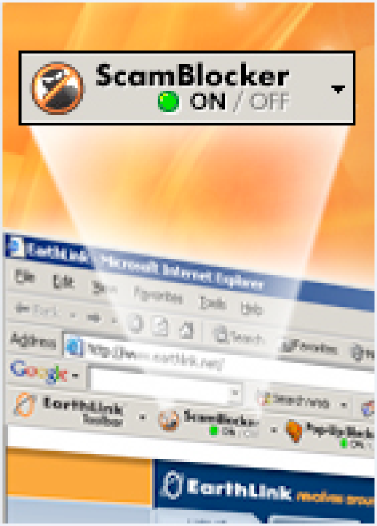
SpoofStick Home - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Options
CORESTREET®
REAL TIME CREDENTIALS
Home
News & Events
Pro

Address http://www.corestreet.com/spoofstick/index.html

You're on corestreet.com

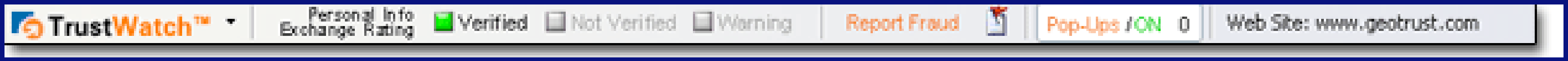
# Earthlink ScamBlocker

- Earthlink keeps list of known fraudulent sites
- Browser toolbar prevents loading known sites, redirects to Earthlink’s servers
- Depends on up-to-date list at Earthlink


ScamBlocker
ON / OFF
EarthLink - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://www.earthlink.net/
Google
EarthLink Toolbar
ScamBlocker
Pop-Up Blocker
EarthLink

# GeoTrust TrustWatch

- GeoTrust rates Websites for trustworthiness and verifies by trusted third party
- Browser toolbar displays color code (green/yellow/red)



# Conclusions

- Phishing continues social engineering in modern vectors (email + Web)
  - Will keep increasing as long as it works
- Current defenses are educational and technological
  - Defenses are trying to keep up with attacks, not keep ahead