

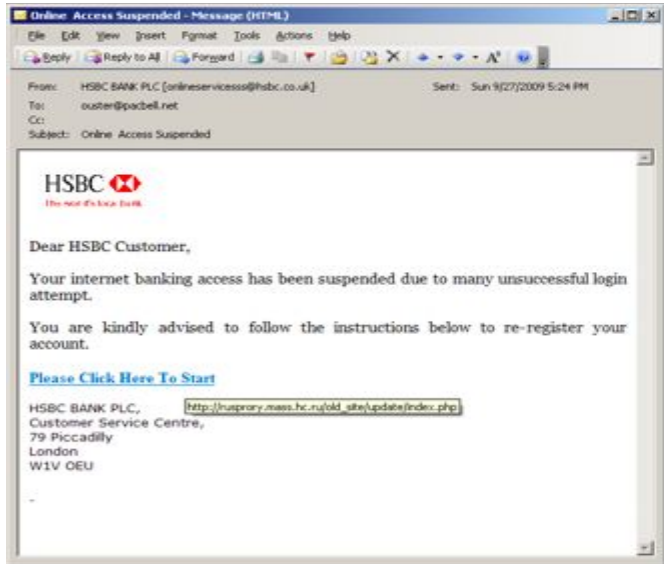
Phishing Attacks

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Phishing

- Basic idea:
 - Get unsuspecting users to visit an evil Web site
 - Convince them that the evil Web site is actually a legitimate site (such as a bank or PayPal)
 - Trick the user into disclosing personal information (password, credit card number, etc.)
 - Use the personal information for evil purposes such as identity theft.
- How to attract users?

Emails

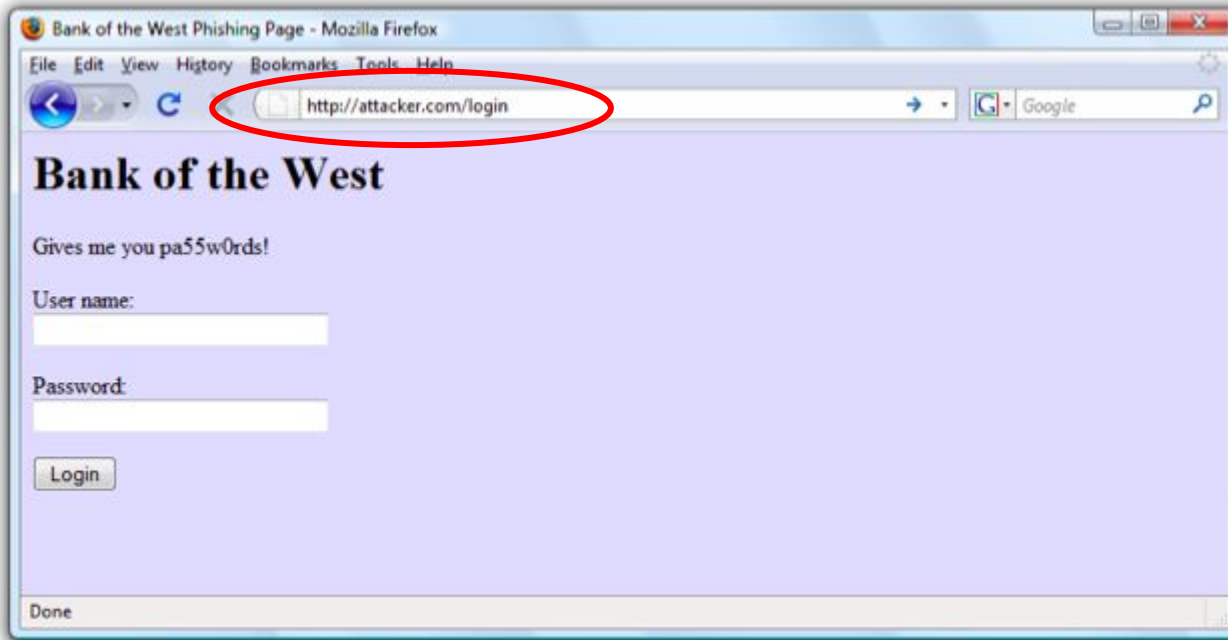


Spoofing legitimate sites

How to spoof the legitimate site?

- Copy HTML
- Include images from legitimate Web site
- Many links refer back to the legitimate Web site
- After collecting login info, log user into legitimate site, redirect to legitimate site
- User has no idea that password has been stolen

URL could be obviously Illegitimate



Or very subtly different: Look-alike characters



International Character Sets

- What does this URL refer to:

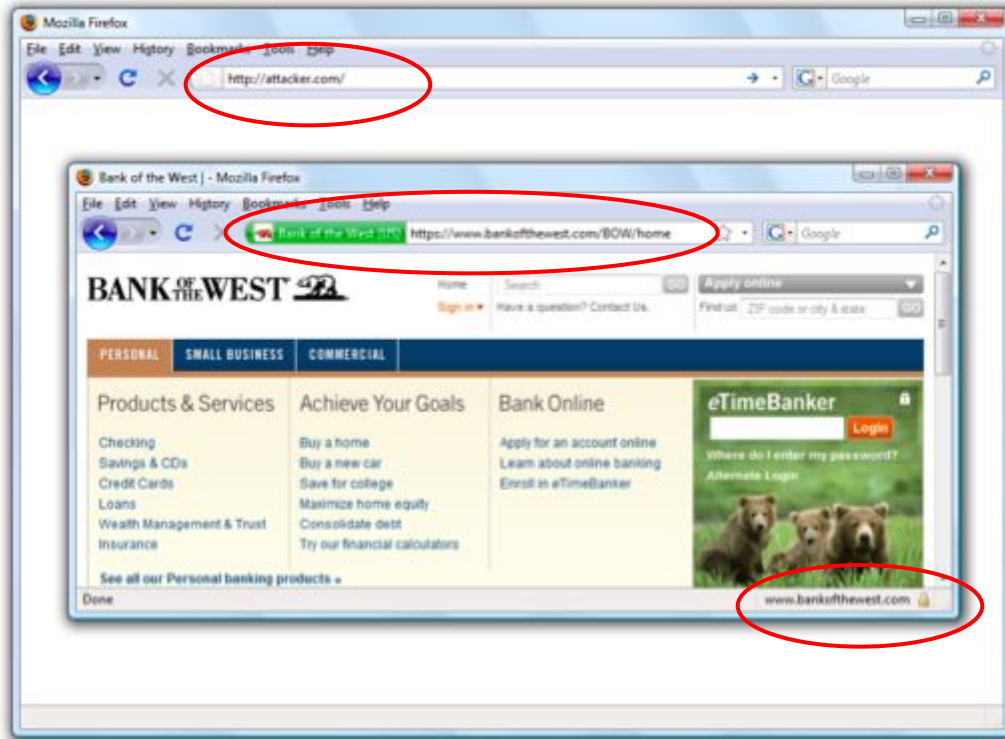
www.bank.com/accounts/login.php?q=me.badguy.cn

Chinese characters that look like "/", "?", and "="

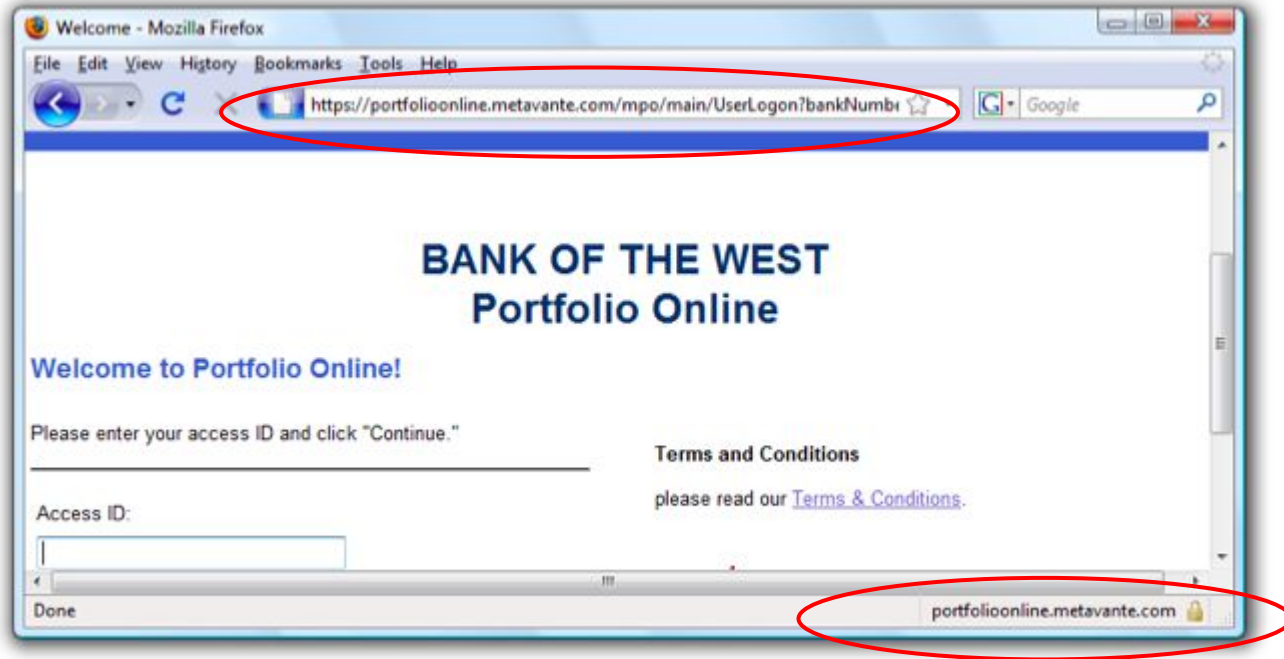


- This is a host name only!

Picture in picture



Legitimate Partners Can Look Fishy



Counter-measure: visual indicators

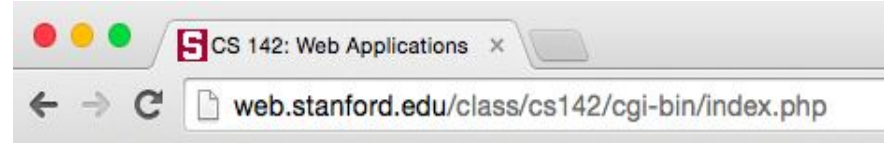
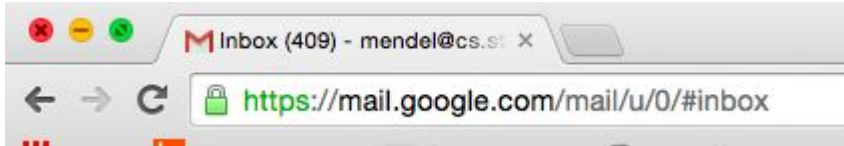
- Help users identify legitimate sites:
- Lock symbols to indicate HTTPS
 - Color change to indicate HTTPS

Problems:

- Lock symbols not always obvious

HTTPS Indicators

Chrome



Safari



Firefox



Problem: too easy to obtain certificates

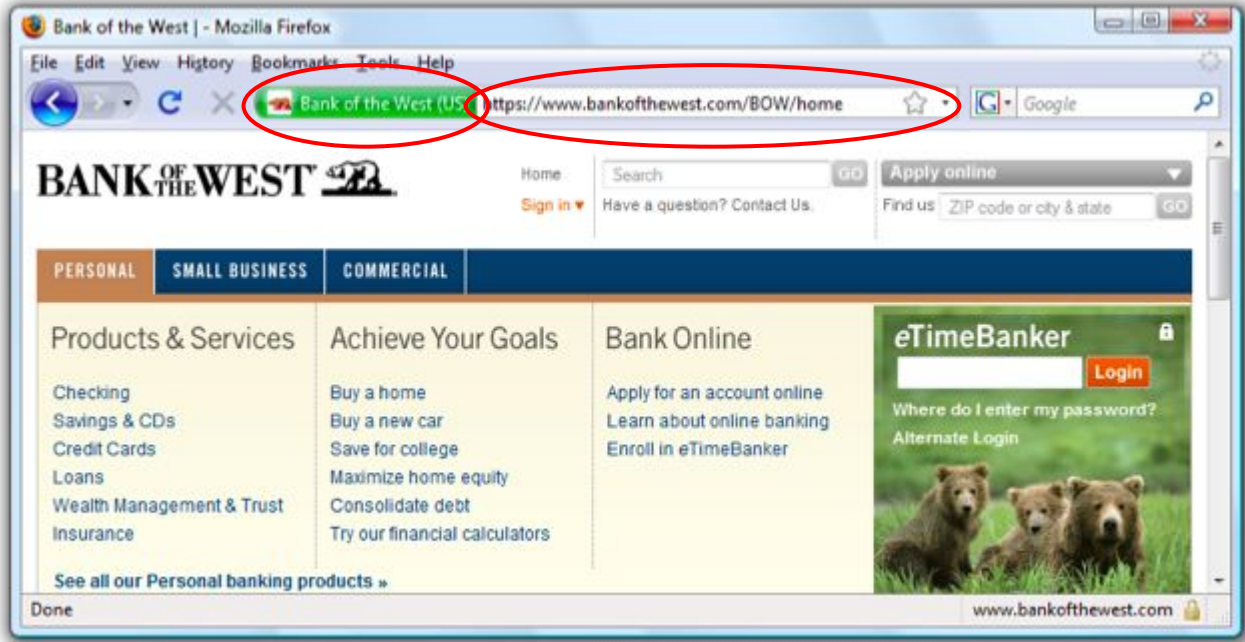
Problem: too easy to obtain certificates that look like legitimate sites

- Example: bankofamerica-secure.com
- Pressure on certificate authorities to issue certificates quickly
- E.g. "domain validation only" certificates: certificate authority only verifies that applicant has right to a particular Internet domain name; no verification of legal status of organization.

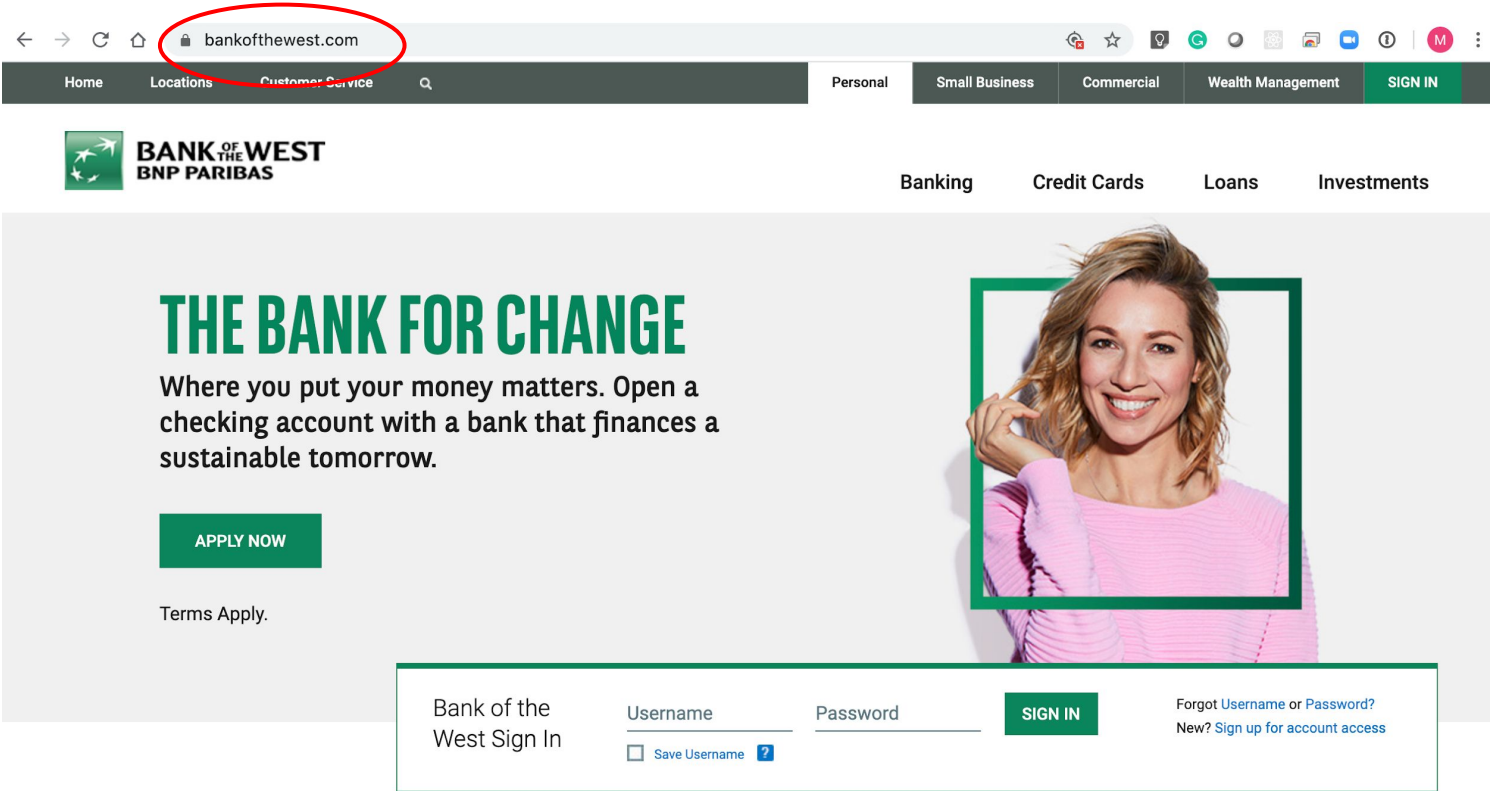
Counter-measure: extended validation certificates

- Goal: prevent attackers from obtaining certificates that look like legitimate sites
- Certificate authority must thoroughly vet the organization obtaining the certificate; prevent look-alike names.
- Certificate authority must undergo audits to ensure it is doing the vets carefully.
- Browser provides special indicator for extended validation sites
- Problems:
 - Small organizations don't like delays and cost of extended validation
 - Browsers are getting rid of indication of HTTPS (including extended) since everything has it.

Extended Validation Certificates a few years ago



Extended Validation Certificates today



The screenshot shows the Bank of the West website. The browser's address bar at the top contains the URL 'bankofthewest.com', which is circled in red. Below the address bar is a navigation menu with options: Home, Locations, Customer Service, Personal, Small Business, Commercial, Wealth Management, and SIGN IN. The main content area features the Bank of the West logo (BNP PARIBAS) and a promotional banner for 'THE BANK FOR CHANGE'. The banner includes the text 'Where you put your money matters. Open a checking account with a bank that finances a sustainable tomorrow.' and an 'APPLY NOW' button. To the right of the text is a photograph of a smiling woman with blonde hair, wearing a pink sweater, framed by a green border. Below the banner is a sign-in form with fields for 'Bank of the West Sign In', 'Username', and 'Password', a 'SIGN IN' button, and a link for 'Forgot Username or Password? New? Sign up for account access'. There is also a 'Save Username' checkbox with a help icon.

bankofthewest.com

Home Locations Customer Service

Personal Small Business Commercial Wealth Management SIGN IN

BANK OF THE WEST
BNP PARIBAS

Banking Credit Cards Loans Investments

THE BANK FOR CHANGE

Where you put your money matters. Open a checking account with a bank that finances a sustainable tomorrow.

[APPLY NOW](#)

Terms Apply.

Bank of the West Sign In

Username Password

Save Username ?

[SIGN IN](#)

[Forgot Username or Password?](#)
[New? Sign up for account access](#)

Other counter-measures:

- Browsers starting to include anti-phishing measures (warn users about known phishing sites)
- Legitimate Web sites can monitor traffic; changes may indicate attacks under way:
 - Spike in download rates for official images
 - Unusual rate of password changes, funds transfers
- Legitimate sites can incorporate personal information in emails to authenticate them: phishers won't have such information.
 - **Spear phishing** - Phishing with attacker having personal information

Other issues

- Legitimate Web sites often use deceptive techniques to get users to click through ("your last chance for ..."), which reduces distinction between honest and dishonest sites.
- Education ineffective against phishing: response rates to phishing e-mails comparable to those for "legitimate" commercial e-mail.
- Warnings about shady certificates are ineffective: people just click through.

Two examples in the news

- Snapchat divulged employee information in phishing attack
 - “Last Friday, Snapchat’s payroll department was targeted by an isolated email phishing scam in which a scammer impersonated our Chief Executive Officer and asked for employee payroll information, ...
- Stanford staff member and student got an email with a Word doc they opened
 - Word doc contained a macro that encrypted the user's home directory and provided instruction how how to buy the encryption key.
 - **Ransomware**
 - Memo: Stanford won't reimburse you for paying ransoms