L22: Authentication & passwords

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Password-based authentication

```
checkpw(user, passwd):
    acct = accounts[user]
    for i in range(0, len(acct.pw)):
        if acct.pw[i] ≠ passwd[i]:
            return False
    return True
```

* Based on Tenex

Password hashing

```
checkpw(user, passwd):
    acct = accounts[user]
    h = SHA1(passwd)
    if acct.pwhash ≠ h:
        return False
    return True
```

Password statistics (leaked list of 32M pws, 2009)

Password Popularity – Top 20

Rank	Password	Number of Users with Password (absolute)
1	123456	290731
2	12345	79078
3	123456789	76790
4	Password	61958
5	iloveyou	51622
6	princess	35231
7	rockyou	22588
8	1234567	21726
9	12345678	20553
10	abc123	17542

Rank	Password	Number of Users with Password (absolute)
11	Nicole	17168
12	Daniel	16409
13	babygirl	16094
14	monkey	15294
15	Jessica	15162
16	Lovely	14950
17	michael	14898
18	Ashley	14329
19	654321	13984
20	Qwerty	13856

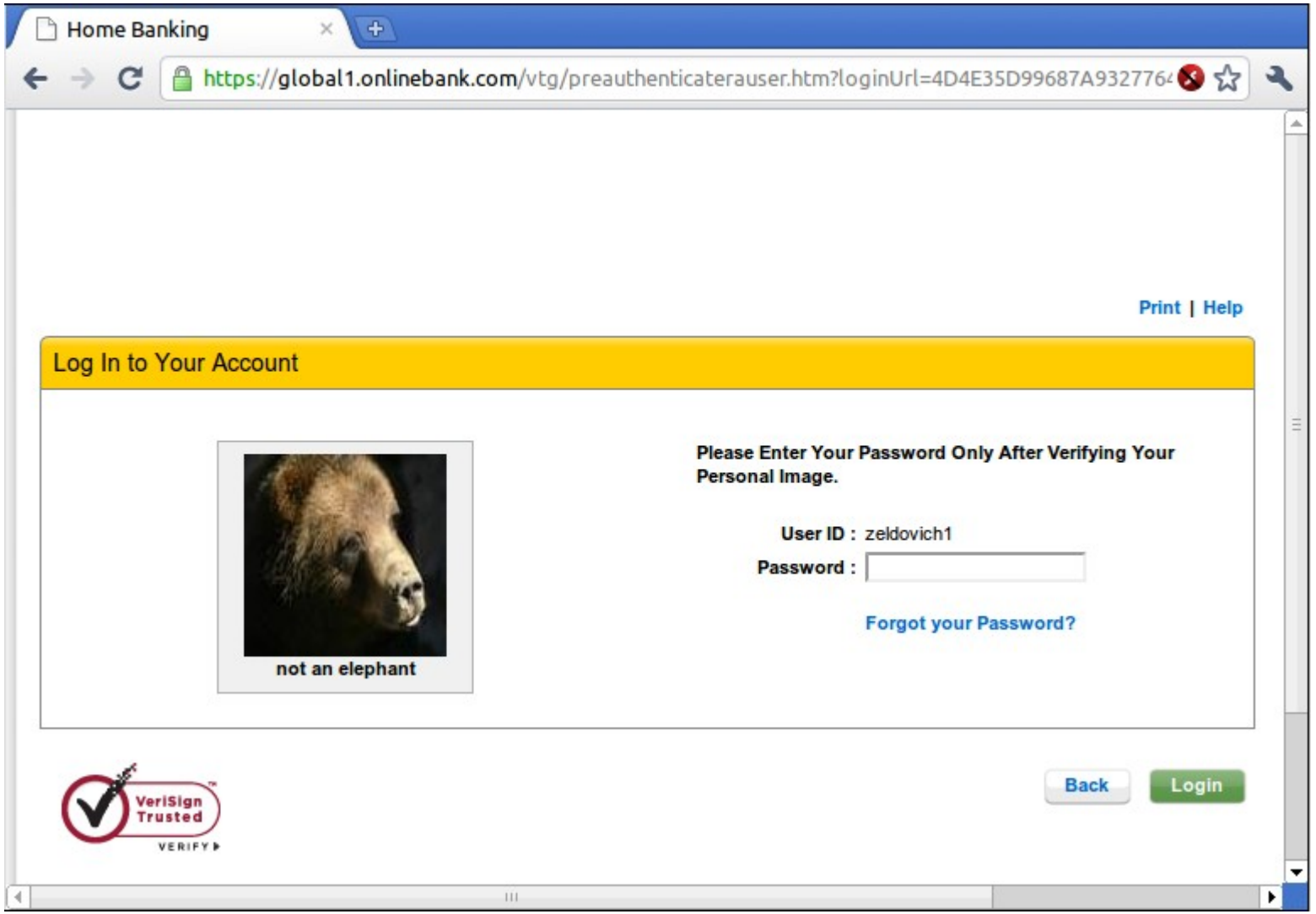
- 5,000 unique passwords account for 20% of users (6.4 million)
- Similar statistics confirmed again in 2010 (Gawker break-in)

* “Consumer Passwords Worst Practices” report by Imperva

Password hashing with salt

```
checkpw(user, passwd):
    acct = accounts[user]
    h = SHA1(acct.pwsalt + passwd)
    if acct.pwhash ≠ h:
        return False
    return True
```

“Sitekey”


Home Banking
https://global1.onlinebank.com/vtg/preauthenticaterauser.htm?loginUrl=4D4E35D99687A932776
Print | Help
Log In to Your Account
not an elephant
Please Enter Your Password Only After Verifying Your Personal Image.
User ID : zeldovich1
Password :
Forgot your Password?
VeriSign Trusted
VERIFY
Back
Login

Summary

- Authentication using passwords
  - Passwords can be easy to guess, reused, long-lived
- Better password protocols can improve security
  - Hashing, salting, challenge-response, …
- Principle: be explicit
  - Avoid hashing ambiguous messages