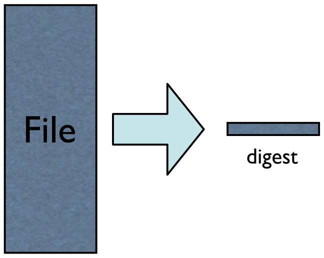
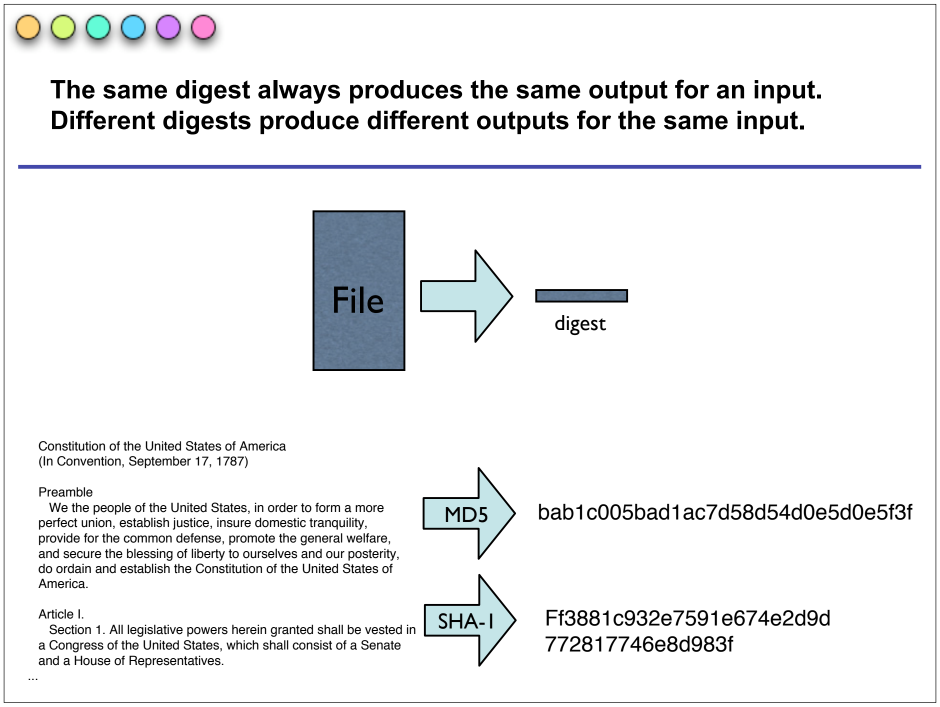
Hour #2
Crypto and
Privacy Protecting Technologies

Message Digests reduce a file to a "fingerprint."

Input: 1-2^{64} bytes

Output: 128, 160, 256 or more bits





The same digest always produces the same output for an input. Different digests produce different outputs for the same input.

File

digest

Constitution of the United States of America
(In Convention, September 17, 1787)

Preamble
We the people of the United States, in order to form a more perfect union, establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessing of liberty to ourselves and our posterity, do ordain and establish the Constitution of the United States of America.

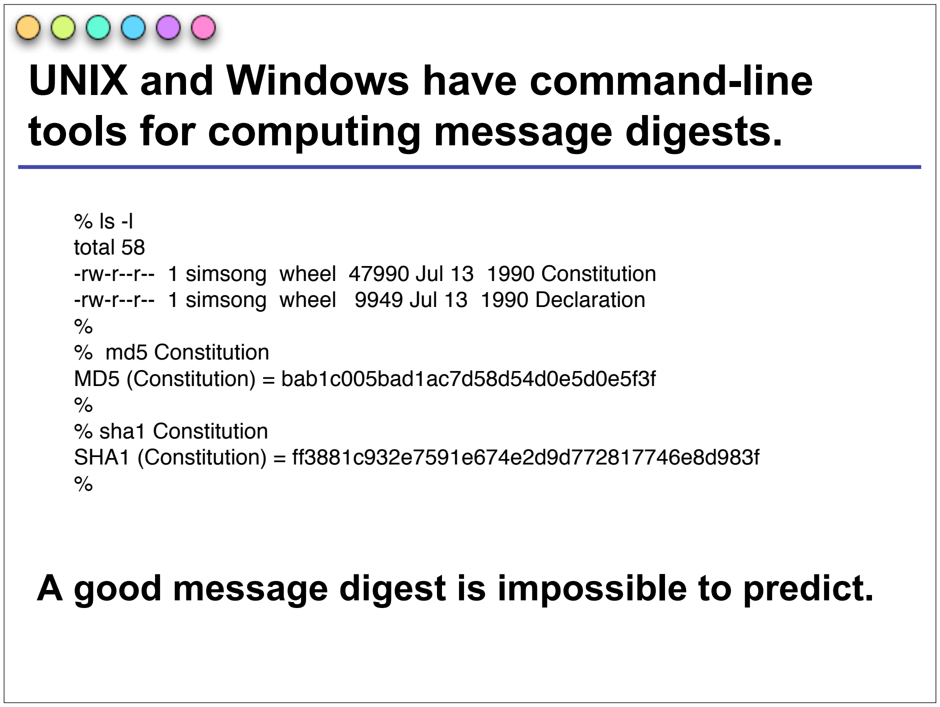
Article I.
Section 1. All legislative powers herein granted shall be vested in a Congress of the United States, which shall consist of a Senate and a House of Representatives.
...

MD5

bab1c005bad1ac7d58d54d0e5d0e5f3f

SHA-1

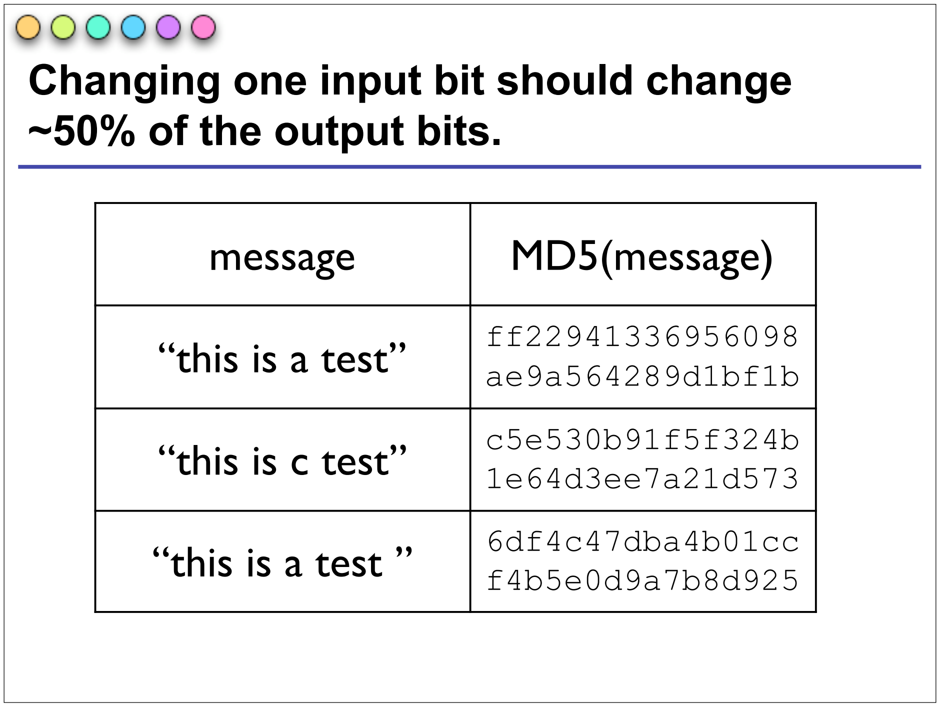
Ff3881c932e7591e674e2d9d
772817746e8d983f



UNIX and Windows have command-line tools for computing message digests.

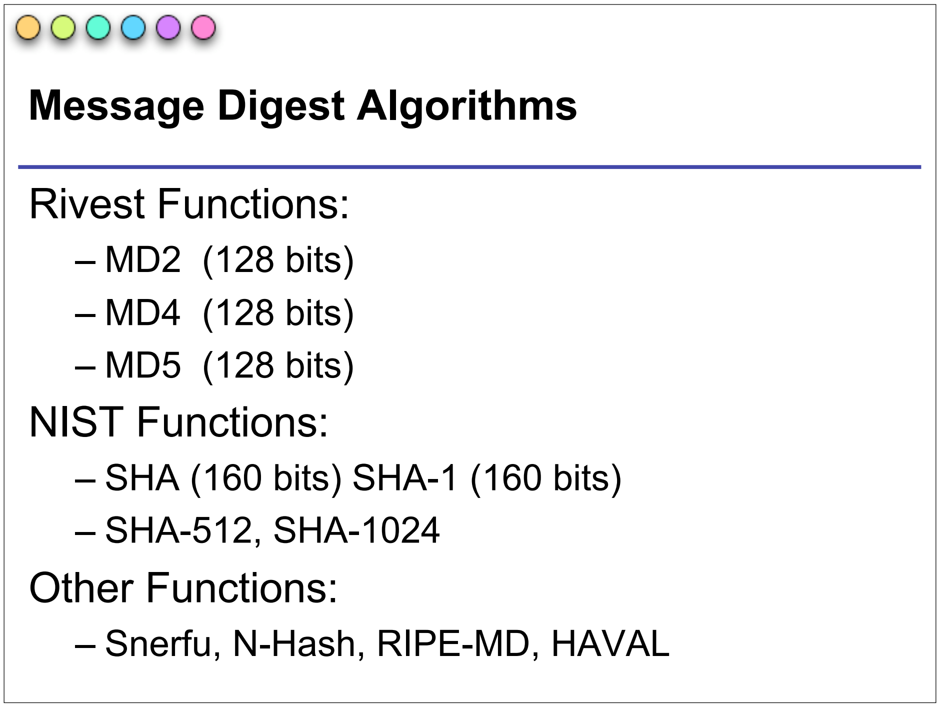
```
% ls -l
total 58
-rw-r--r--  1 simsong  wheel  47990 Jul 13  1990 Constitution
-rw-r--r--  1 simsong  wheel   9949 Jul 13  1990 Declaration
%
%  md5 Constitution
MD5 (Constitution) = bab1c005bad1ac7d58d54d0e5d0e5f3f
%
% sha1 Constitution
SHA1 (Constitution) = ff3881c932e7591e674e2d9d772817746e8d983f
%
```

A good message digest is impossible to predict.



Changing one input bit should change ~50% of the output bits.

message	MD5(message)
“this is a test”	ff22941336956098 ae9a564289d1bf1b
“this is c test”	c5e530b91f5f324b 1e64d3ee7a21d573
“this is a test ”	6df4c47dba4b01cc f4b5e0d9a7b8d925



Message Digest Algorithms

Rivest Functions:

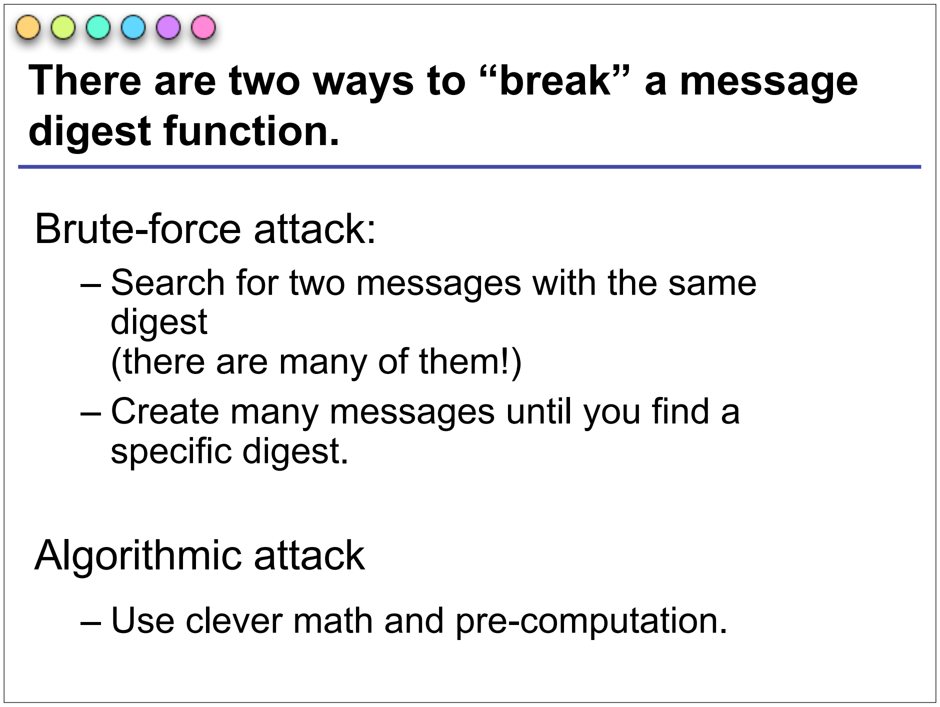
- MD2 (128 bits)
- MD4 (128 bits)
- MD5 (128 bits)

NIST Functions:

- SHA (160 bits) SHA-1 (160 bits)
- SHA-512, SHA-1024

Other Functions:

- Snerfu, N-Hash, RIPE-MD, HAVAL



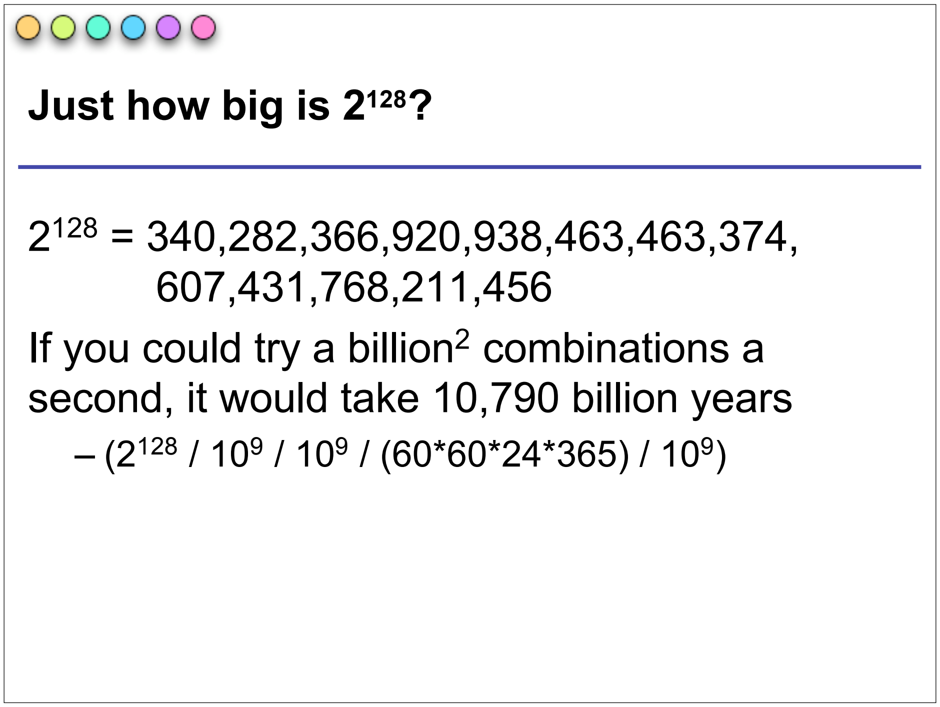
There are two ways to “break” a message digest function.

Brute-force attack:

- Search for two messages with the same digest
  (there are many of them!)
- Create many messages until you find a specific digest.

Algorithmic attack

- Use clever math and pre-computation.



Just how big is 2^{128}?

2^{128} = 340,282,366,920,938,463,463,374,
607,431,768,211,456

If you could try a billion^{2} combinations a second, it would take 10,790 billion years

- (2^{128} / 10^{9} / 10^{9} / (60*60*24*365) / 10^{9})

MD5 “Broken”

“Collisions for Hash Functions MD4, MD5, HAVAL-128 and RIPEMD,” Xiaoyun Wang and Dengguo Feng and Xuejia Lai and Hongbo Yu, August 16, 2004

http://eprint.iacr.org/2004/199/

Here is an MD5 collision:

```
file1.dat:

  00000000  d1 31 dd 02 c5 e6 ee c4  69 3d 9a 06 98 af f9 5c
  00000010  2f ca b5 87 12 46 7e ab  40 04 58 3e b8 fb 7f 89
  00000020  55 ad 34 06 09 f4 b3 02  83 e4 88 83 25 71 41 5a
  00000030  08 51 25 e8 f7 cd c9 9f  d9 1d bd f2 80 37 3c 5b
  00000040  96 0b 1d d1 dc 41 7b 9c  e4 d8 97 f4 5a 65 55 d5
  00000050  35 73 9a c7 f0 eb fd 0c  30 29 f1 66 d1 09 b1 8f
  00000060  75 27 7f 79 30 d5 5c eb  22 e8 ad ba 79 cc 15 5c
  00000070  ed 74 cb dd 5f c5 d3 6d  b1 9b 0a d8 35 cc a7 e3

  MD5(file1.dat) = a4c0d35c95a63a805915367dcfe6b751

file2.dat:

  00000000  d1 31 dd 02 c5 e6 ee c4  69 3d 9a 06 98 af f9 5c
  00000010  2f ca b5 07 12 46 7e ab  40 04 58 3e b8 fb 7f 89
  00000020  55 ad 34 06 09 f4 b3 02  83 e4 88 83 25 f1 41 5a
  00000030  08 51 25 e8 f7 cd c9 9f  d9 1d bd 72 80 37 3c 5b
  00000040  96 0b 1d d1 dc 41 7b 9c  e4 d8 97 f4 5a 65 55 d5
  00000050  35 73 9a 47 f0 eb fd 0c  30 29 f1 66 d1 09 b1 8f
  00000060  75 27 7f 79 30 d5 5c eb  22 e8 ad ba 79 4c 15 5c
  00000070  ed 74 cb dd 5f c5 d3 6d  b1 9b 0a 58 35 cc a7 e3

  MD5(file2.dat) = a4c0d35c95a63a805915367dcfe6b751
```

Uses of Digest Functions

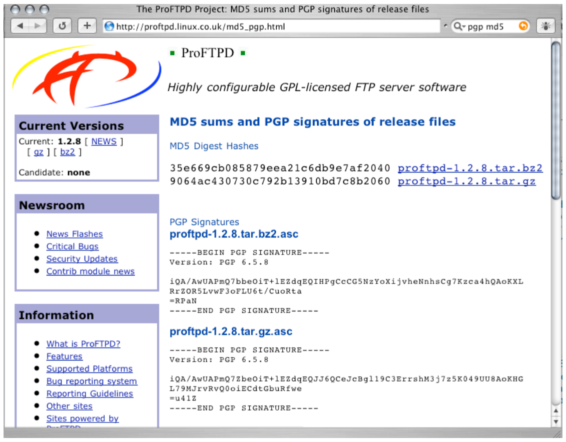
Integrity

- Verifying downloaded code
- Use Digest to determine if two files are identical
- Verifying SSL streams

Authentication

- verifying a shared secret w/o encryption

MD5 hashes are commonly used to verify downloaded code.


The ProFTPD Project: MD5 sums and PGP signatures of release files
http://proftpd.linux.co.uk/md5_pgp.html
pgp md5
ProFTPD

Highly configurable GPL-licensed FTP server software

Current Versions

Current: **1.2.8** [NEWS]
[gz] [bz2]

Candidate: **none**

Newsroom

- News Flashes
- Critical Bugs
- Security Updates
- Contrib module news

Information

- What is ProFTPD?
- Features
- Supported Platforms
- Bug reporting system
- Reporting Guidelines
- Other sites
- Sites powered by

MD5 sums and PGP signatures of release files

MD5 Digest Hashes

```
35e669cb085879eea21c6db9e7af2040 proftpd-1.2.8.tar.bz2
9064ac430730c792b13910bd7c8b2060 proftpd-1.2.8.tar.gz
```

PGP Signatures

proftpd-1.2.8.tar.bz2.asc

```
-----BEGIN PGP SIGNATURE-----
Version: PGP 6.5.8

iQA/AwUAPmQ7bbeOiT+lEZdqEQIHPgCcCG5NzYoXijvheNnhsCg7Kzca4hQAoKXL
RrZOR5LvwF3oFLU6t/CuoRta
=RPaN
-----END PGP SIGNATURE-----
```

proftpd-1.2.8.tar.gz.asc

```
-----BEGIN PGP SIGNATURE-----
Version: PGP 6.5.8

iQA/AwUAPmQ7ZbeOiT+lEZdqEQJJ6QCeJcBgl19C3ErrshM3j7z5K049UU8AoKHG
L79MJrvRvQ0oiECdtGbuRfwe
=u41Z
-----END PGP SIGNATURE-----
```

In this application, MD5’s “break” is irrevellant.

Hashes can be used to securely store passwords.

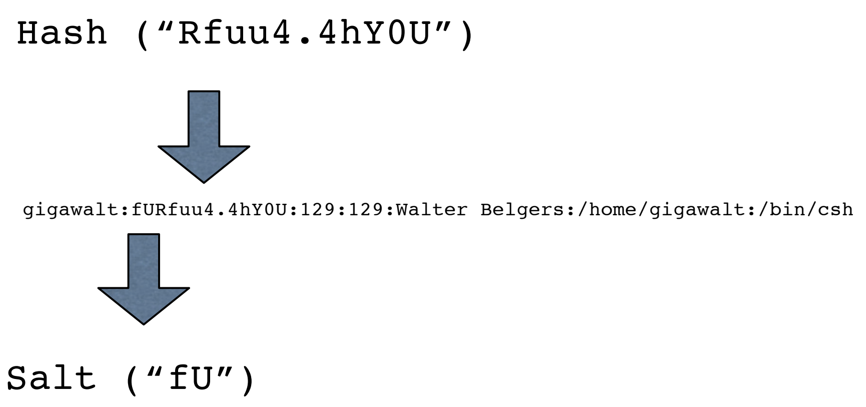
```
gigawalt:fURfuu4.4hY0U:129:129:Walter Belgers:/home/gigawalt:/bin/csh

root:$1$zlC9.Vfl$9rXSaQqe1HWDaNNOSTJzh.:0:0::0:0:Nitroba &:/root:/bin/tcsh
```

Instead of storing the password, store the hash of the password.

“Cracking” the password requires hashing every password entry to see if it matches the hash.

Unix originally used a DES-based hash, now it uses an MD5 hash.

password file has both salt and encrypted pw



```
Hash (“Rfuu4.4hY0U”)

gigawalt:fURfuu4.4hY0U:129:129:Walter Belgers:/home/gigawalt:/bin/csh

Salt (“fU”)
```

The “salt” assures that the same password can encrypt many different ways.

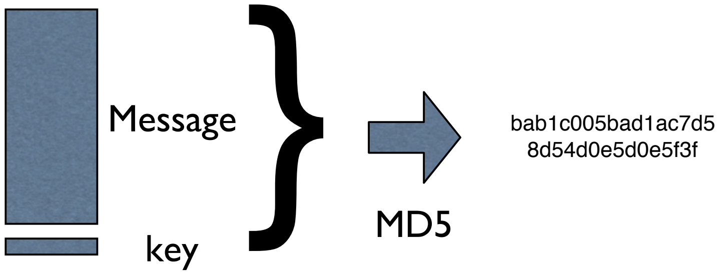
MACs and HMACs allow hash functions to be used for authentication.

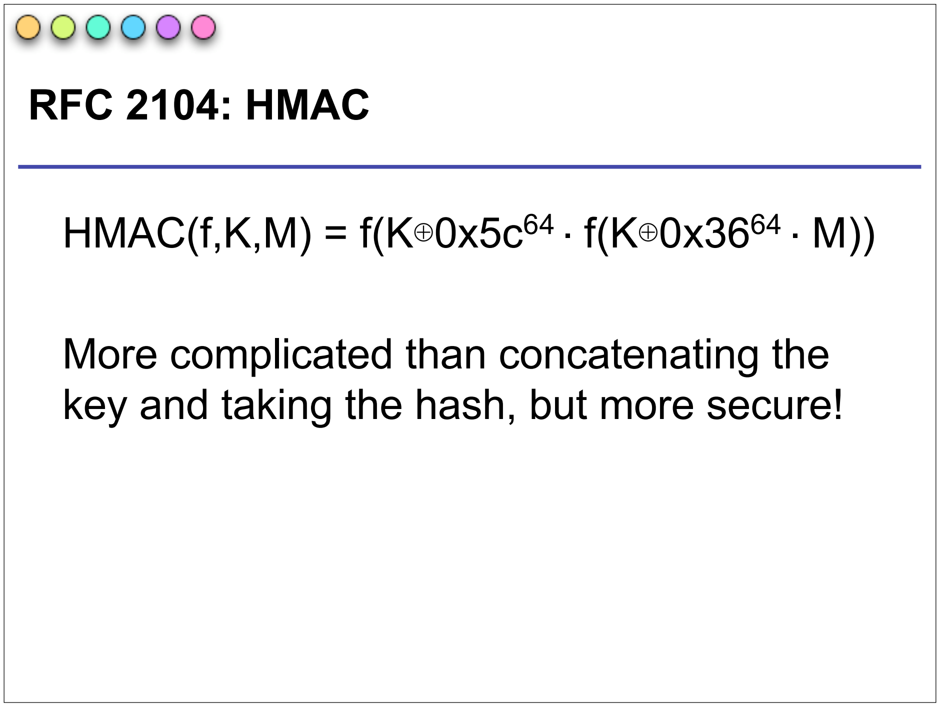
MAC = “Message Authentication Code”

HMAC = “Keyed Hashing for Message Authentication” (RFC 2104)

- http://www.ietf.org/rfc/rfc2404.txt
- http://www.cs.ucsd.edu/users/mihir/papers/hmac.html

MACs: The Big Idea

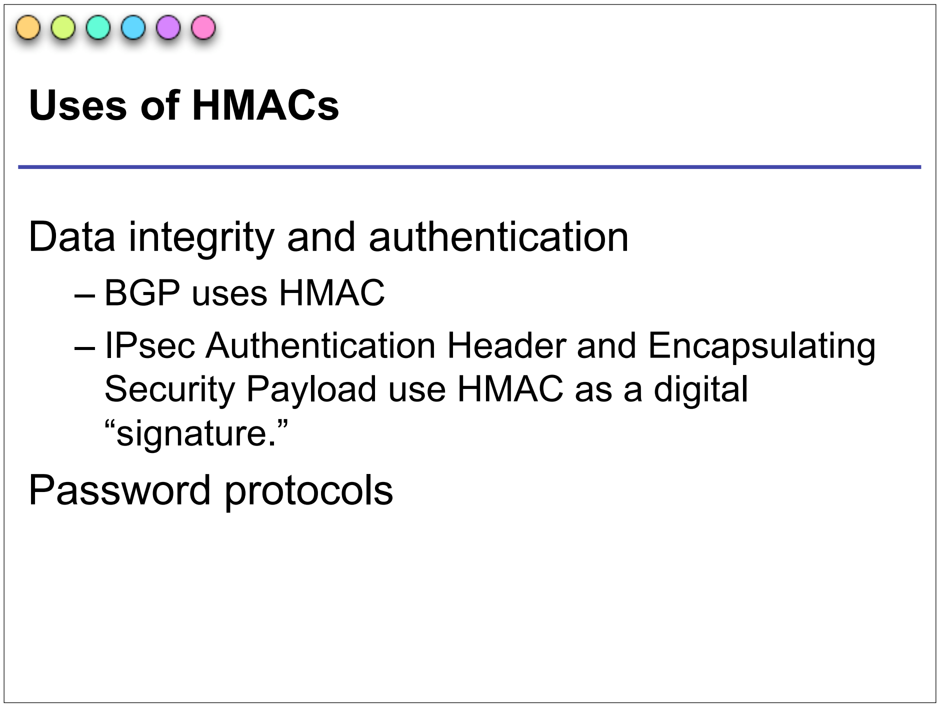




RFC 2104: HMAC

$\mathrm{HMAC}(f,K,M) = f(K \oplus 0x5c^{64} \cdot f(K \oplus 0x36^{64} \cdot M))$

More complicated than concatenating the key and taking the hash, but more secure!

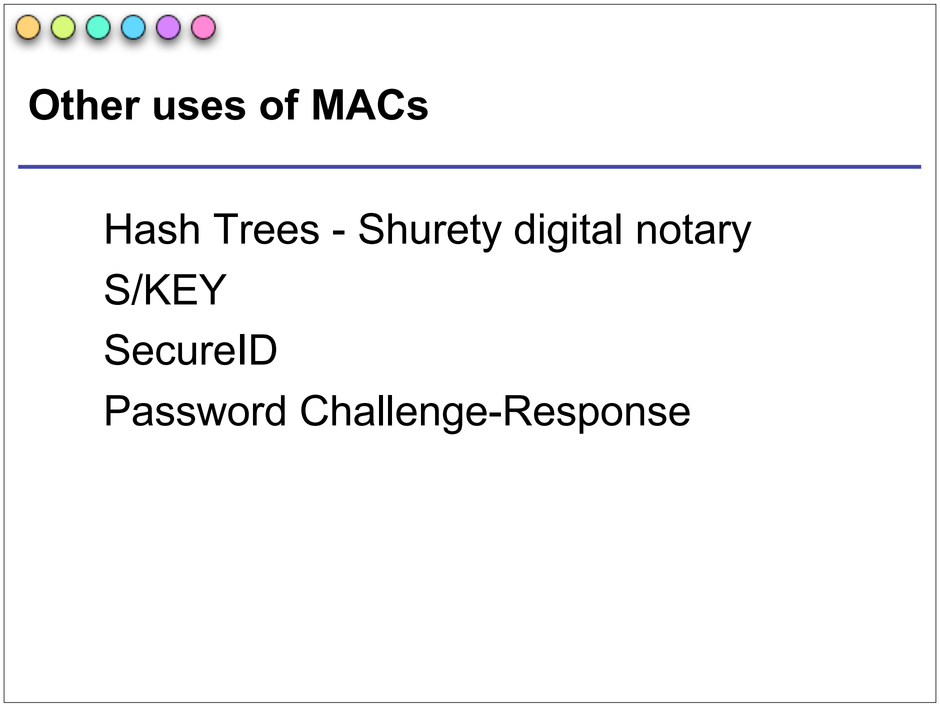


Uses of HMACs

Data integrity and authentication

- BGP uses HMAC
- IPsec Authentication Header and Encapsulating Security Payload use HMAC as a digital “signature.”

Password protocols



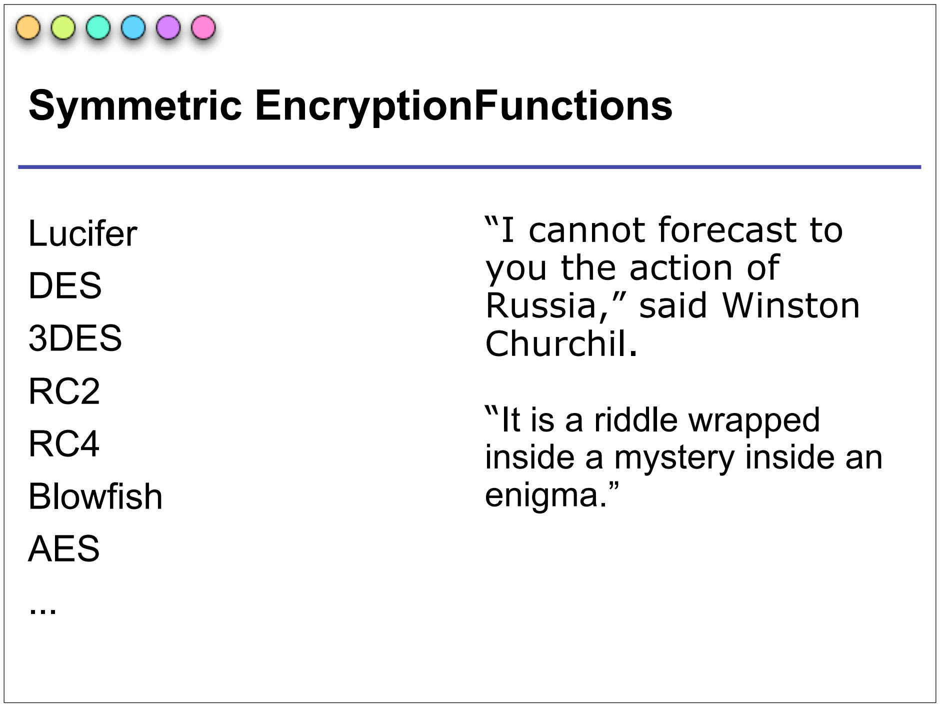
Other uses of MACs

Hash Trees - Shurety digital notary

S/KEY

SecureID

Password Challenge-Response



Symmetric EncryptionFunctions

Lucifer

DES

3DES

RC2

RC4

Blowfish

AES

...

"I cannot forecast to you the action of Russia," said Winston Churchil.

"It is a riddle wrapped inside a mystery inside an enigma."

Symmetric Functions: the key that seals also unseals.

M’ = f(M,key) *encryption* or *sealing*

M = f’(M’,key) *decryption* or *unsealing*

f=f’ or f≠f’ (some algorithms have a decrypt mode, some don’t need it).

Germany used the “Enigma Machine” to encipher communications in WW.

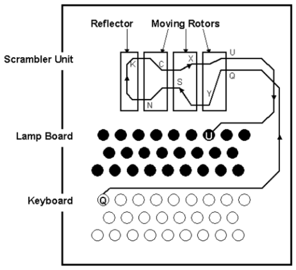
Code clerks set the “code of the day” on dials.

Later models: Set additional code with plugs and wires.

Press a button with the letter to encrypt; the encrypted letter lights up.

Each key press advances the dials

Inside the Enigma



http://www.math.miami.edu/~harald/enigma/enigma.gif

After WW2, cryptography remained a military interest.

Academia was largely disinterested

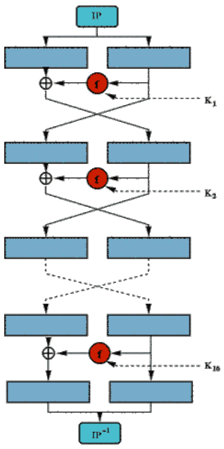
The US National Security Agency became the largest Employer of mathematicians in the world.

IBM developed the “Lucipher” cipher to encrypt data for ATM networks.

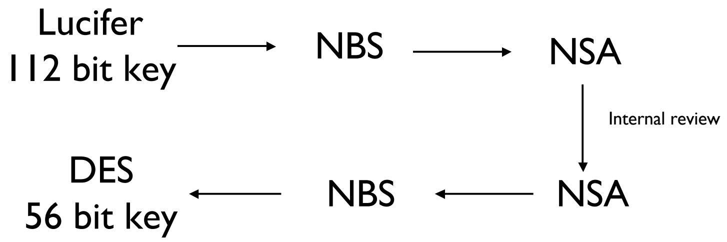
The client: Lloyds of London

The algorithm:

- Symmetric Algorithm
- Fiestel Network
- explicit encrypt/decrypt
- 112 bit key
- Substitution and transposition within 8-character blocks



IBM submitted “Lucifer” to the National Bureau of Standards.



Lucifer
112 bit key

NBS

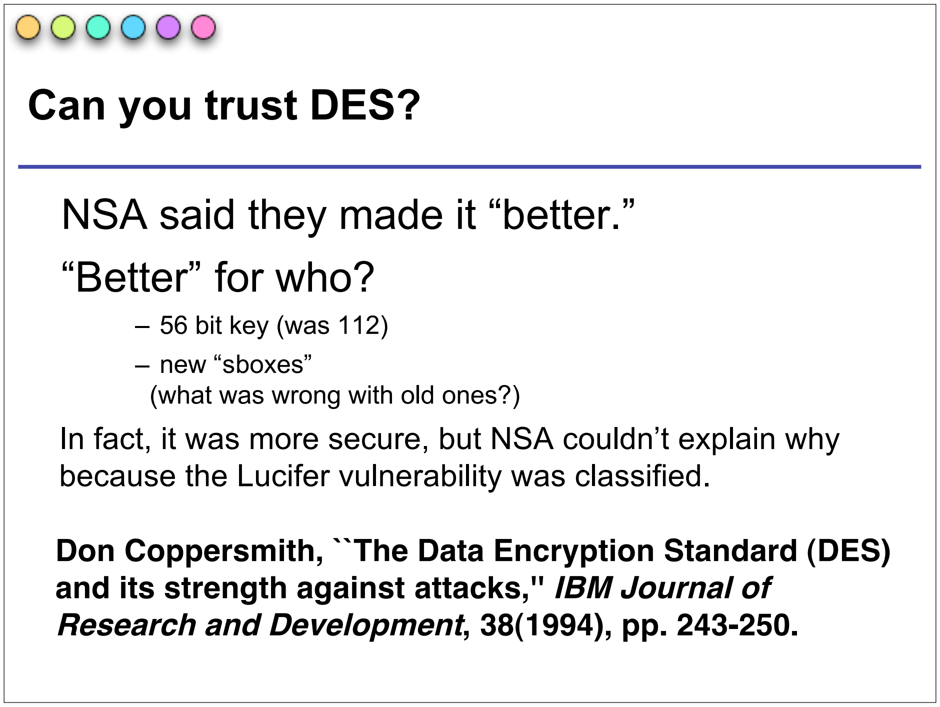
NSA

Internal review

NSA

NBS

DES
56 bit key



Can you trust DES?

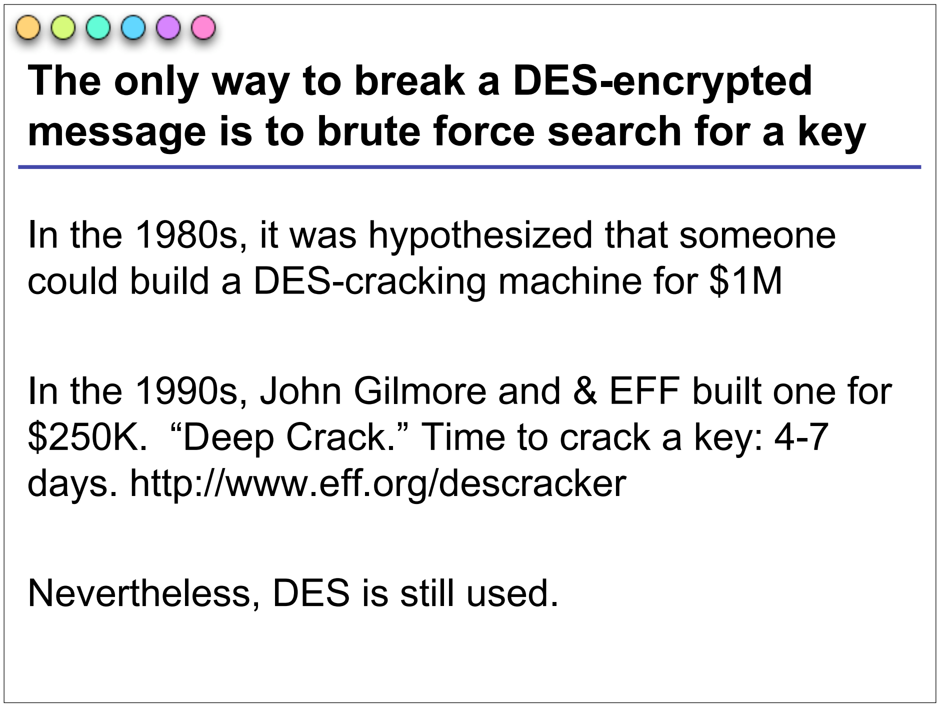
NSA said they made it “better.”

“Better” for who?

- 56 bit key (was 112)
- new “sboxes”
  (what was wrong with old ones?)

In fact, it was more secure, but NSA couldn’t explain why because the Lucifer vulnerability was classified.

Don Coppersmith, ``The Data Encryption Standard (DES) and its strength against attacks,'' *IBM Journal of Research and Development*, 38(1994), pp. 243-250.

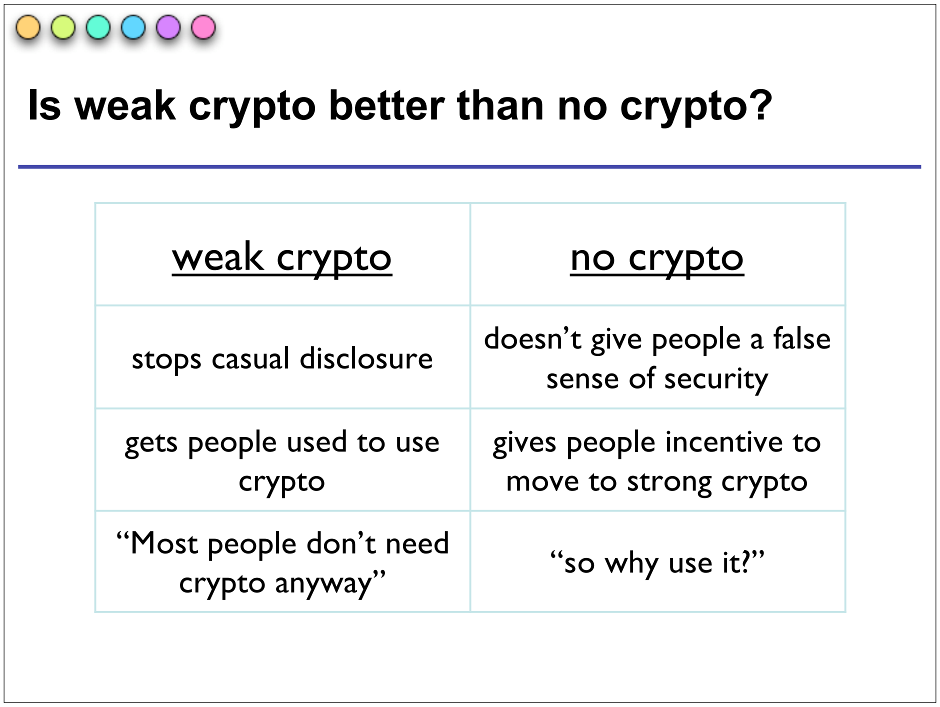


The only way to break a DES-encrypted message is to brute force search for a key

In the 1980s, it was hypothesized that someone could build a DES-cracking machine for $1M

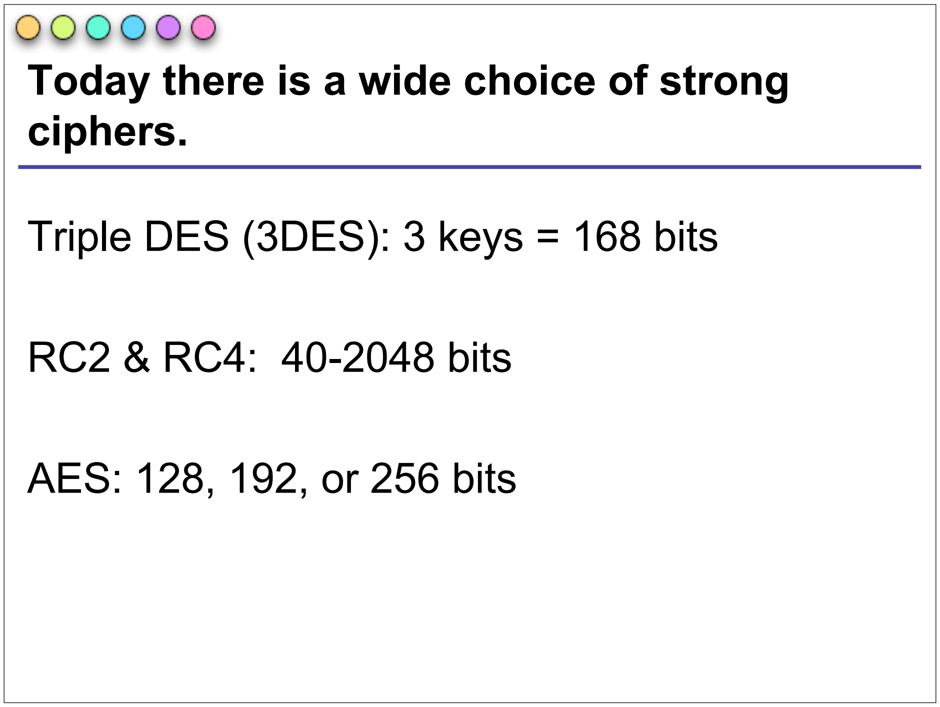
In the 1990s, John Gilmore and & EFF built one for $250K. “Deep Crack.” Time to crack a key: 4-7 days. http://www.eff.org/descracker

Nevertheless, DES is still used.



Is weak crypto better than no crypto?

weak crypto	no crypto
stops casual disclosure	doesn’t give people a false sense of security
gets people used to use crypto	gives people incentive to move to strong crypto
“Most people don’t need crypto anyway”	“so why use it?”



Today there is a wide choice of strong ciphers.

Triple DES (3DES): 3 keys = 168 bits

RC2 & RC4: 40-2048 bits

AES: 128, 192, or 256 bits

Modes of Operation define how a block cipher is used on data longer than a block.

ECB - Electronic Code Book

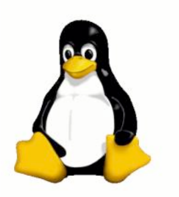
CBC - Cipher Block Chaining

CFB - Cipher Feed Back (XOR generator)

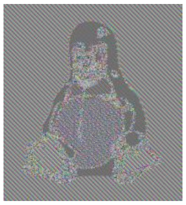
Counter Mode

A strong cipher with the wrong mode of operation can have no effective security.

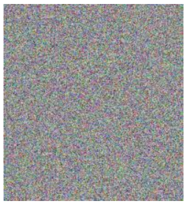
In general, Electronic Code Book (ECB) is easy to implement but not very secure.



original

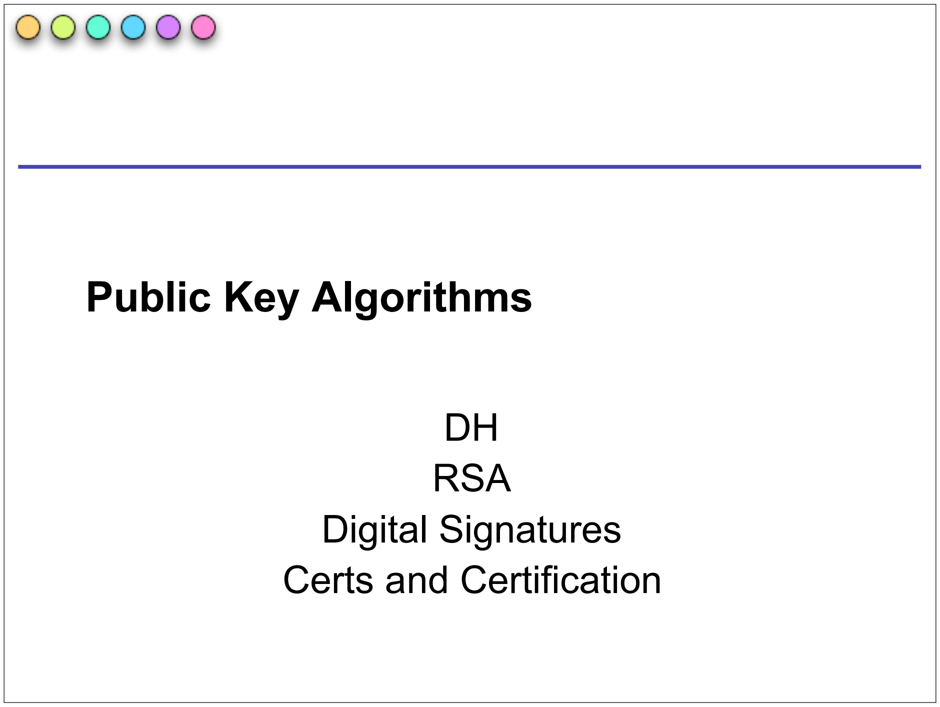


ECB



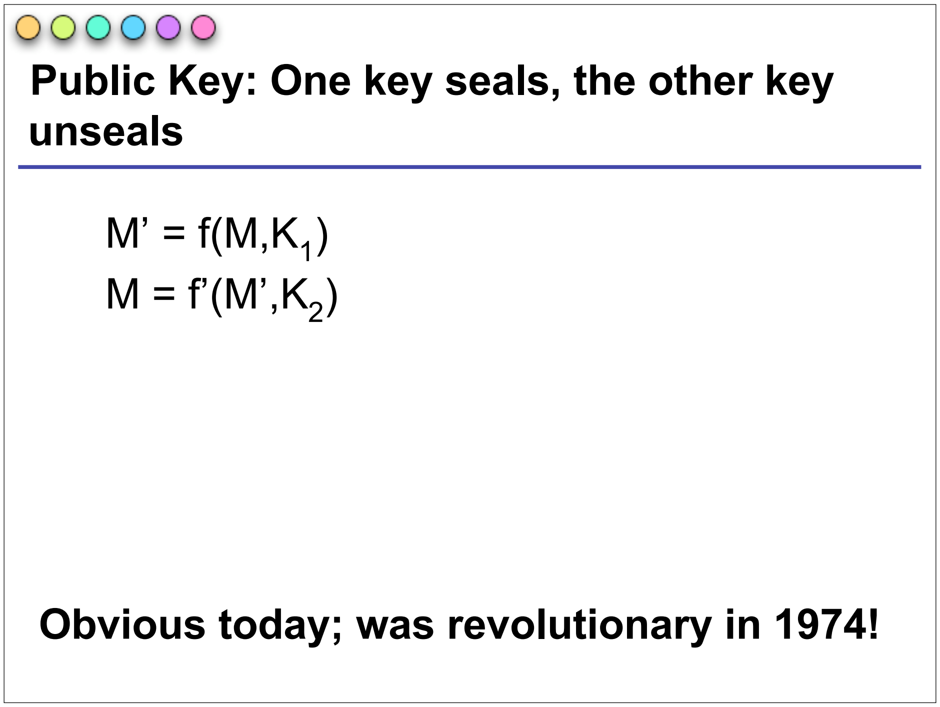
CBC

http://en.wikipedia.org/wiki/Block_cipher_modes_of_operation



Public Key Algorithms

DH
RSA
Digital Signatures
Certs and Certification



Public Key: One key seals, the other key unseals

$M' = f(M, K_1)$

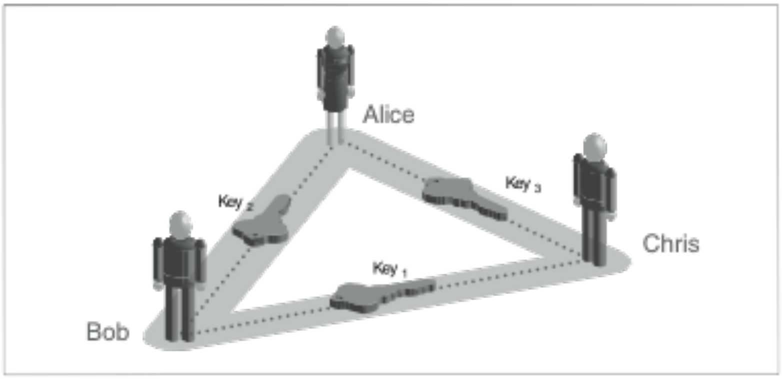
$M = f'(M', K_2)$

Obvious today; was revolutionary in 1974!

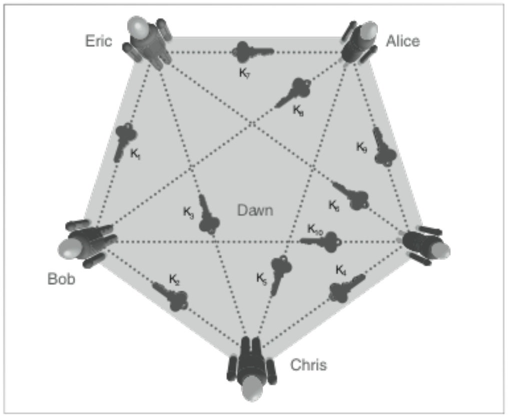
Secret Key vs. Public Key

	secret key	public key
algorithm type	symmetric	asymmetric
basis	substitution and transposition	math
speed	fast	slow
encrypts	blocks of data	numbers
uses	encrypting files	encrypting email

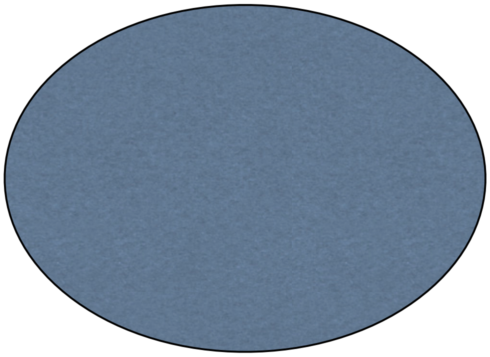
With symmetric cryptography, 3 people need 3 keys to communicate.



Five people need 10 keys to communicate.



And 1000 people need 499,550 keys to communicate.



$$\# \text{ keys} = \frac{(n)(n-1)}{2}$$

Public key cryptography uses two keys.

Public key = seals/encrypts data
Private key = unseals/decrypts data

Secret key
Key pair
Public key

Whitten's "Metaphor Tailoring."

Ralph Merkle figured this out in 1974, but nobody understood it!

Reviewers at ACM didn't understand the project!

- –"Too far out of the mainstream of cryptography."
- –"Bad science: everybody knows that it is important to keep cryptography keys secret."

Communications finally published the paper in 1978, with an editorial note.

Whitfield Diffie & Matin Hellman

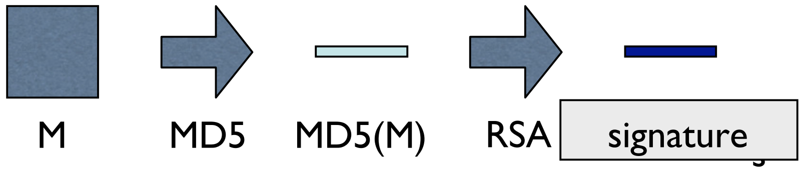
“Multi-User Cryptographic Techniques,” written in fall 1975 for the 1976 National Computer Conference

Proposed the idea of Public Key Cryptography.

May 1976 - Diffie Hellman algorithm invented.

Interactive protocol for 2 participants.

Digital Signatures

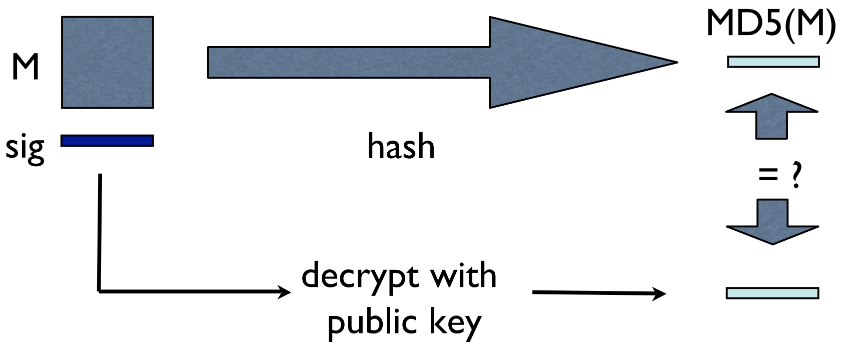


Encrypt with the *secret* key, decrypt with the *public* key.

Used for verifying that the signer had the private key.

Instead of encrypting the entire Message, we usually encrypt a hash

Verifying a Digital Signature



If the hash matches the decrypted signature, the signature verifies!

Using Digital Signatures

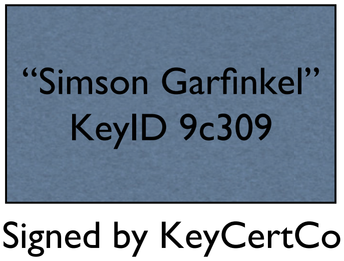
To sign a digital signature, you need...

- –your private key.

To verify a digital signature, you need...

- –the other person’s public key...
- –the name of the algorithm the person has used for the digital signature.

Certificates bind public keys to identities. [Kohnfelder ‘78]



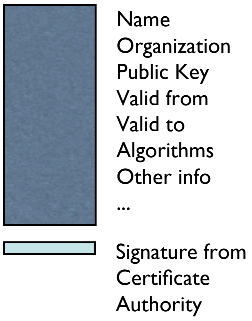
Digital Certificates

Certificates “register” public keys

Certificates are signed with digital signatures!

Certificates signed by a “Certificate Authority”

X.509:



Certificate Authorities

Issue Certificates, not keys

Process:

- User creates public/private keypair
- User sends Certificate Signing Request (CSR) to the CA.
- CA verifies the sender's identity.
- CA sends the certificate back to the user.

What good is a Certificate from a CA?

In Theory:

- Allows you to "prove your identity" on the Internet. (Age, Sex, Name)
- Allows you to digitally sign documents.
- Allows users to prove "membership" without having to distribute a membership list.

In practice:

- Allows you to run an SSL server without a warning

Certificate Revocation Lists (CRLs)

List of “mistakes.”

- –User lost their Private key.
- –CA signed the wrong key.

Technically, should be checked whenever a CA cert is trusted.

Most application do not check CRLs.

Most public key systems are actually hybrid systems.

- –Use Diffie-Hellman or RSA to exchange a 128-bit session key
- –Use RC2/RC4/AES to encrypt bulk information
- –Use certificates to vouch for public keys.

Certs and Keys with OpenSSL

OpenSSL command-line interface:

- –Useful for making keys, certs and CSRs.
- –Useful for simple testing
- –Useful for converting one format to another (handles PKCS, PEM, and others)
- –Useful for testing SSL servers

OpenSSL Commands

ca - Certificate Authority Management

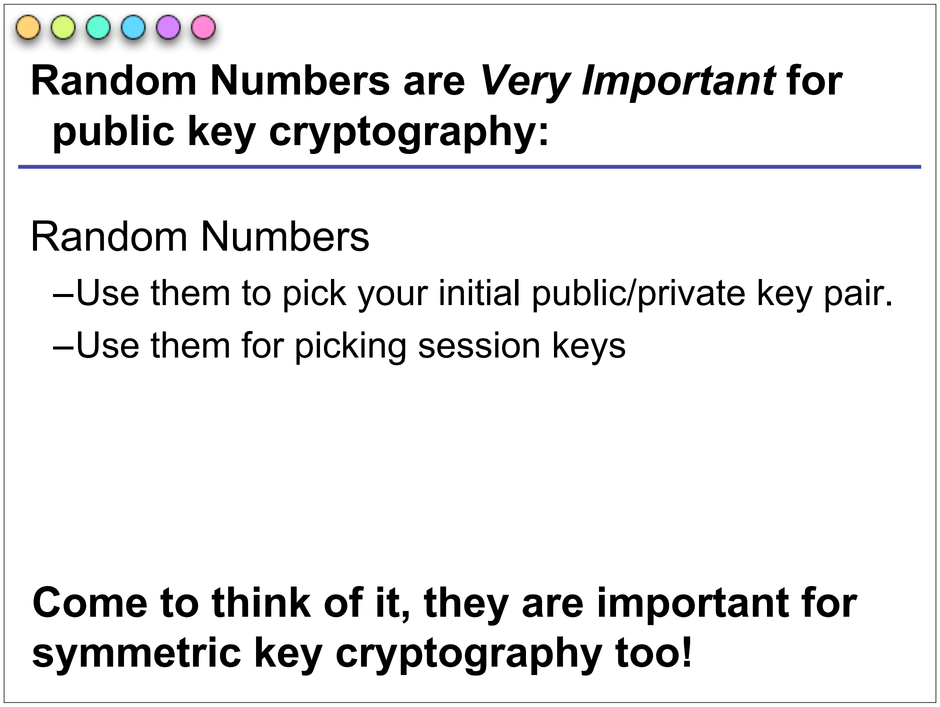
ciphers - lists ciphers in your implementation

crl - Manage Certificate Revocation Lists

dgst - calculation of md digests

dsa - Manages DSA algorithm

dsparam - Generate and manage DH keys

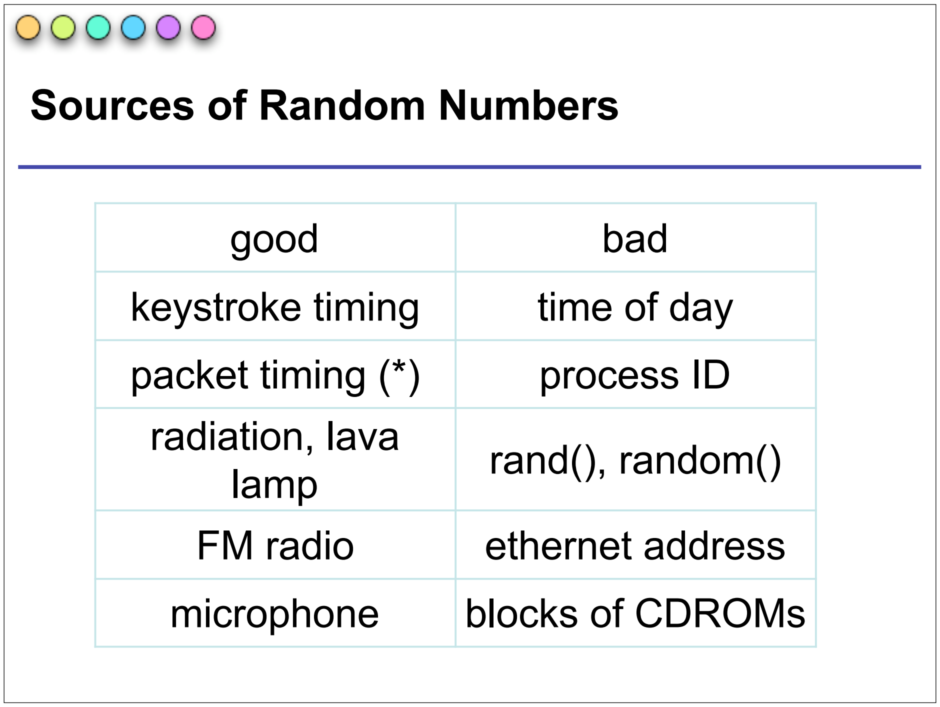


Random Numbers are *Very Important* for public key cryptography:

Random Numbers

- –Use them to pick your initial public/private key pair.
- –Use them for picking session keys

Come to think of it, they are important for symmetric key cryptography too!



Sources of Random Numbers

good	bad
keystroke timing	time of day
packet timing (*)	process ID
radiation, lava lamp	rand(), random()
FM radio	ethernet address
microphone	blocks of CDROMs

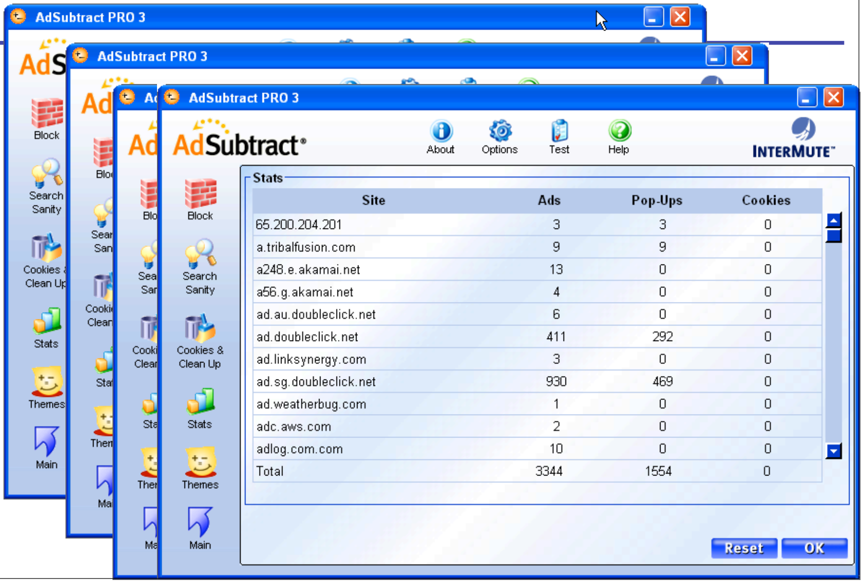
The OpenSSL system supports many ciphers and MAC functions

```
% openssl ciphers
EDH-RSA-DES-CBC3-SHA:EDH-DSS-DES-CBC3-SHA:DES-CBC3-
SHA:DES-CBC3-MD5:DHE-DSS-RC4-SHA:IDEA-CBC-SHA:RC4-
SHA:RC4-MD5:IDEA-CBC-MD5:RC2-CBC-MD5:RC4-MD5:RC4-64-
MD5:EXP1024-DHE-DSS-RC4-SHA:EXP1024-RC4-SHA:EXP1024-DHE-
DSS-DES-CBC-SHA:EXP1024-DES-CBC-SHA:EXP1024-RC2-CBC-
MD5:EXP1024-RC4-MD5:EDH-RSA-DES-CBC-SHA:EDH-DSS-DES-CBC-
SHA:DES-CBC-SHA:DES-CBC-MD5:EXP-EDH-RSA-DES-CBC-SHA:EXP-
EDH-DSS-DES-CBC-SHA:EXP-DES-CBC-SHA:EXP-RC2-CBC-MD5:EXP-
RC4-MD5:EXP-RC2-CBC-MD5:EXP-RC4-MD5
```

Privacy Protecting Technologies

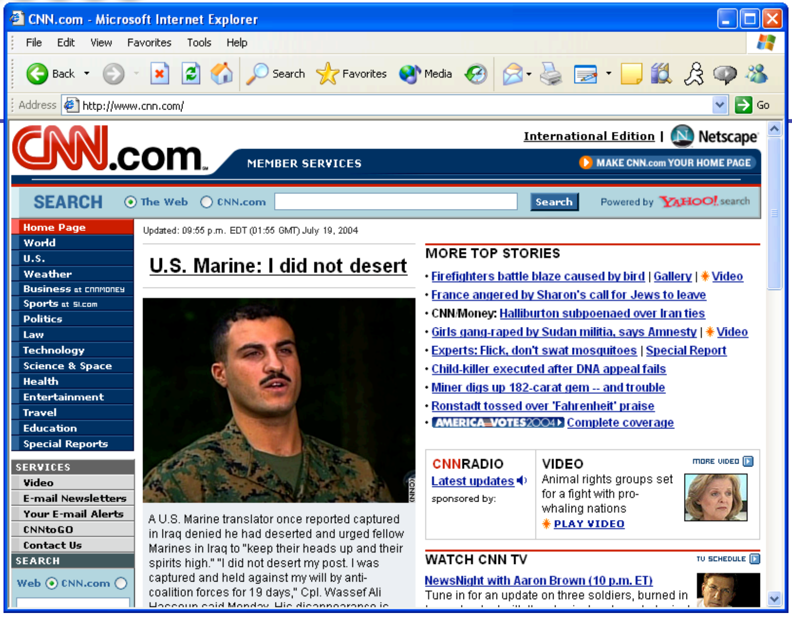
Using technology to improve privacy.

Ad Subtract



Stats

Site	Ads	Pop-Ups	Cookies
65.200.204.201	3	3	0
a.tribalfusion.com	9	9	0
a248.e.akamai.net	13	0	0
a56.g.akamai.net	4	0	0
ad.au.doubleclick.net	6	0	0
ad.doubleclick.net	411	292	0
ad.linksynergy.com	3	0	0
ad.sg.doubleclick.net	930	469	0
ad.weatherbug.com	1	0	0
adc.aws.com	2	0	0
adlog.com.com	10	0	0
Total	3344	1554	0



Address http://www.cnn.com/

Updated: 09:55 p.m. EDT (01:55 GMT) July 19, 2004

U.S. Marine: I did not desert

A U.S. Marine translator once reported captured in Iraq denied he had deserted and urged fellow Marines in Iraq to "keep their heads up and their spirits high." "I did not desert my post. I was captured and held against my will by anti-coalition forces for 19 days," Cpl. Wassef Ali Hassoun said Monday. His disappearance is

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- Child-killer executed after DNA appeal fails
- Miner digs up 182-carat gem -- and trouble
- Ronstadt tossed over 'Fahrenheit' praise
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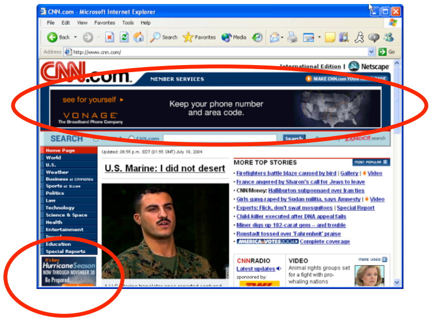
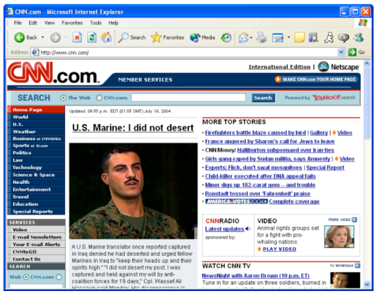
VIDEO
Animal rights groups set for a fight with pro-whaling nations
PLAY VIDEO

WATCH CNN TV

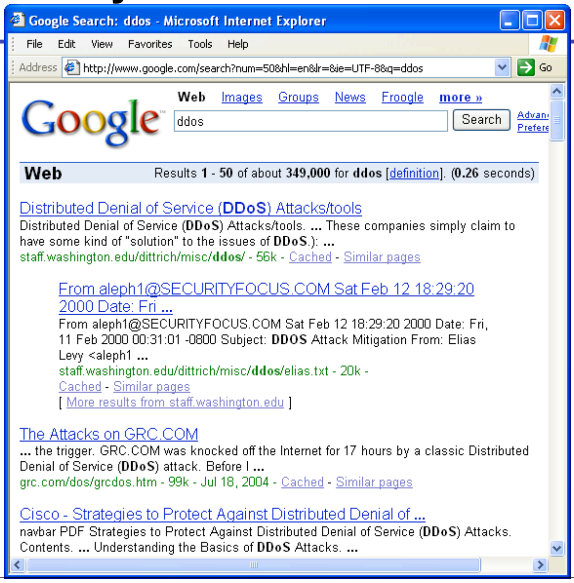
NewsNight with Aaron Brown (10 p.m. ET)
Tune in for an update on three soldiers, burned in


CNN.com - Microsoft Internet Explorer
CNN.com
MEMBER SERVICES
see for yourself
Keep your phone number and area code.
VONAGE
SEARCH
U.S. Marine: I did not desert
MORE TOP STORIES
Hurricane Season


CNN.com - Microsoft Internet Explorer
CNN.com
MEMBER SERVICES
SEARCH
U.S. Marine: I did not desert
MORE TOP STORIES
WATCH CNN TV

10:40 PM
Monday
7/19/2004

“Search Sanity”


Google Search: ddos - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address
Go
Web Images Groups News Froogle more »
Search
Advanced
Preferences

http://www.google.com/search?num=50&hl=en&lr=&ie=UTF-8&q=ddos

ddos

Web Results **1** - **50** of about **349,000** for **ddos** [definition]. (**0.26** seconds)

Distributed Denial of Service (DDoS) Attacks/tools
Distributed Denial of Service (**DDoS**) Attacks/tools. **...** These companies simply claim to have some kind of "solution" to the issues of **DDoS**.): **...**
staff.washington.edu/dittrich/misc/**ddos**/ - 56k - Cached - Similar pages

From aleph1@SECURITYFOCUS.COM Sat Feb 12 18:29:20 2000 Date: Fri ...
From aleph1@SECURITYFOCUS.COM Sat Feb 12 18:29:20 2000 Date: Fri, 11 Feb 2000 00:31:01 -0800 Subject: **DDOS** Attack Mitigation From: Elias Levy <aleph1 **...**
staff.washington.edu/dittrich/misc/**ddos**/elias.txt - 20k - Cached - Similar pages
[More results from staff.washington.edu]

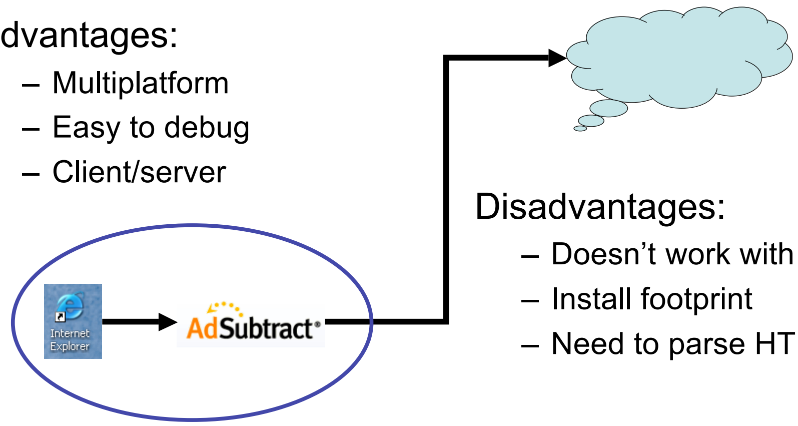
The Attacks on GRC.COM
... the trigger. GRC.COM was knocked off the Internet for 17 hours by a classic Distributed Denial of Service (**DDoS**) attack. Before I **...**
grc.com/dos/grcdos.htm - 99k - Jul 18, 2004 - Cached - Similar pages

Cisco - Strategies to Protect Against Distributed Denial of ...
navbar PDF Strategies to Protect Against Distributed Denial of Service (**DDoS**) Attacks. Contents. **...** Understanding the Basics of **DDoS** Attacks. **...**

Ad Subtract:
Client-Side Java Proxy

Advantages:

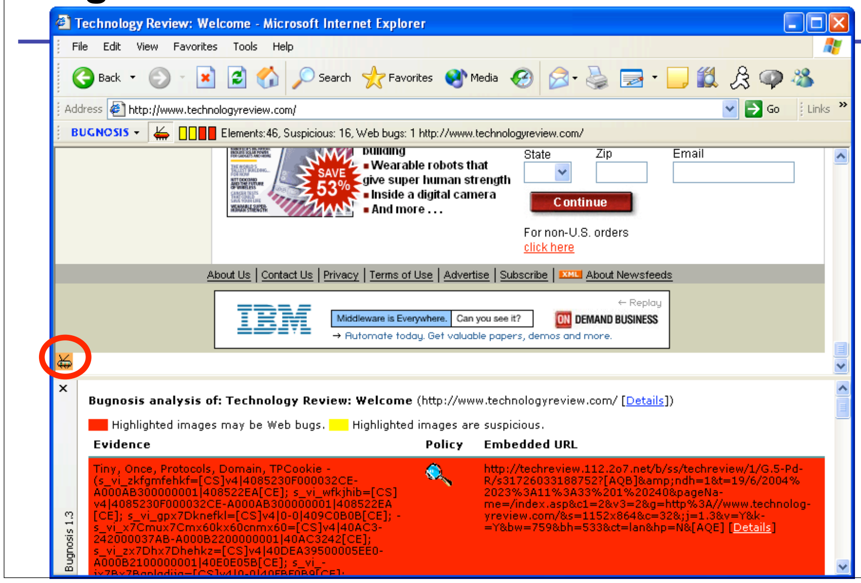
- Multiplatform
- Easy to debug
- Client/server



Disadvantages:

- Doesn’t work with SSL
- Install footprint
- Need to parse HTML

Bugnosis


Technology Review: Welcome - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Media
Address
Go
Links
BUGNOSIS
SAVE 53%
State
Zip
Email
Continue
About Us | Contact Us | Privacy | Terms of Use | Advertise | Subscribe | XML About Newsfeeds
IBM
Middleware is Everywhere.
Can you see it?
← Replay
ON DEMAND BUSINESS
→ Automate today. Get valuable papers, demos and more.
Bugnosis 1.3

http://www.technologyreview.com/

Elements:46, Suspicious: 16, Web bugs: 1 http://www.technologyreview.com/

building
- Wearable robots that give super human strength
- Inside a digital camera
- And more . . .

For non-U.S. orders
click here

Bugnosis analysis of: Technology Review: Welcome (http://www.technologyreview.com/ [Details])

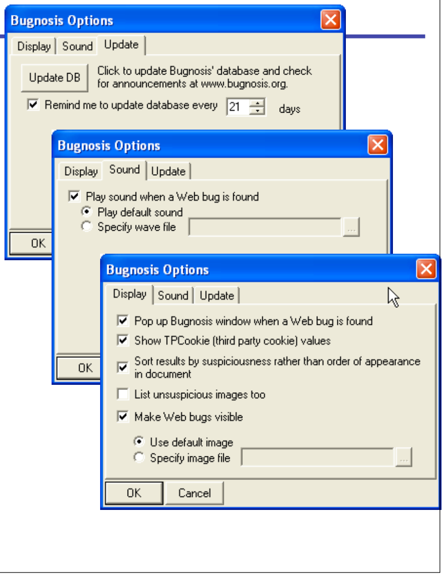
🟥 Highlighted images may be Web bugs. 🟨 Highlighted images are suspicious.

Evidence	Policy	Embedded URL
Tiny, Once, Protocols, Domain, TPCookie - (s_vi_zkfgmfehkf=[CS]v4|4085230F000032CE-A000AB300000001|408522EA[CE]; s_vi_wfkjhib=[CS]v4|4085230F000032CE-A000AB300000001|408522EA[CE]; s_vi_gpx7Dknefkl=[CS]v4|0-0|409C0B0B[CE]; -s_vi_x7Cmux7Cmx60kx60cnmx60=[CS]v4|40AC3-242000037AB-A000B2200000001|40AC3242[CE]; s_vi_zx7Dhx7Dhehkz=[CS]v4|40DEA39500005EE0-A000B2100000001|40E0E05B[CE]; s_vi_-ix7Bx7Bgpladiiq=[CS]v4|0-0|40EBF0B9[CE];	🔍	http://techreview.112.2o7.net/b/ss/techreview/1/G.5-Pd-R/s31726033188752?[AQB]&amp;ndh=1&t=19/6/2004%2023%3A11%3A33%201%20240&pageName=/index.asp&c1=2&v3=2&g=http%3A//www.technologyreview.com/&s=1152x864&c=32&;j=1.3&v=Y&k-=Y&bw=759&bh=533&ct=lan&hp=N&[AQE] [Details]

Bugnosis

Features:

- Browser helper object
- Accesses HTTP & HTTPS
- Downloads updates
- Designed for journalists



Click to update Bugnosis' database and check for announcements at www.bugnosis.org.

☑ Remind me to update database every 21 days

☑ Play sound when a Web bug is found
● Play default sound
○ Specify wave file

☑ Pop up Bugnosis window when a Web bug is found
☑ Show TPCookie (third party cookie) values
☑ Sort results by suspiciousness rather than order of appearance in document
☐ List unsuspicious images too
☑ Make Web bugs visible
● Use default image
○ Specify image file

Private Messaging

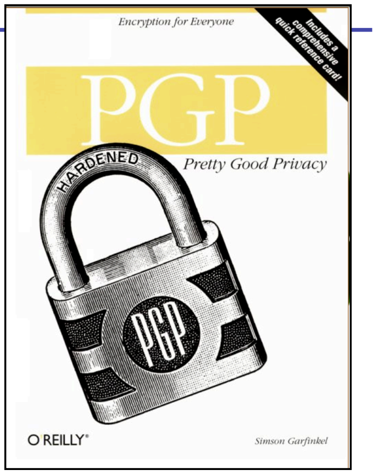
PGP – first generation

Hush Mail – web based

The Martus Project – application specific

Disappearing Ink (Omniva) - Deletion

PGP

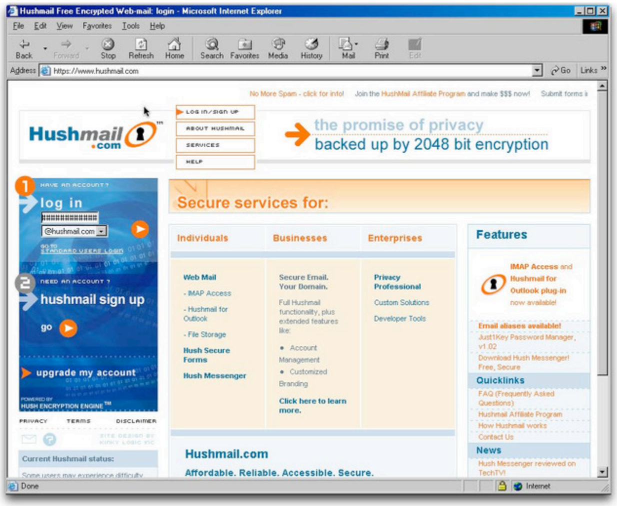


Add-on
Plug-in
S/MIME vs. OpenPGP
Political Baggage

Hush Mail

Second-generation
Web-based
Java Crypto Client

Hush Mail



https://www.hushmail.com

No More Spam - click for info! Join the HushMail Affiliate Program and make $$$ now! Submit forms i

the promise of privacy
backed up by 2048 bit encryption

1 HAVE AN ACCOUNT?
log in
@hushmail.com
GO TO STANDARD USERS LOGIN

2 NEED AN ACCOUNT ?
hushmail sign up

upgrade my account

POWERED BY HUSH ENCRYPTION ENGINE™

SITE DESIGN BY KINKY LOGIC INC

Current Hushmail status:
Some users may experience difficulty

Secure services for:

Individuals	Businesses	Enterprises
Web Mail - IMAP Access - Hushmail for Outlook - File Storage Hush Secure Forms Hush Messenger	Secure Email. Your Domain. Full Hushmail functionality, plus extended features like: • Account Management • Customized Branding Click here to learn more.	Privacy Professional Custom Solutions Developer Tools

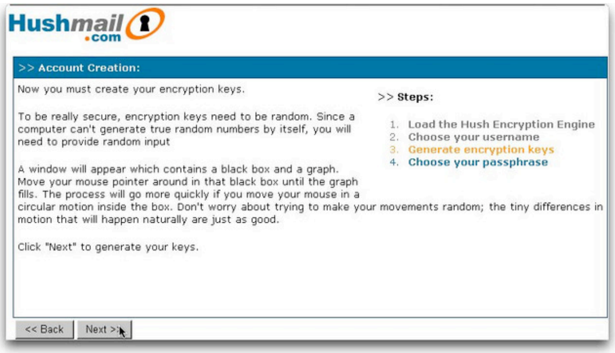
Hushmail.com
Affordable. Reliable. Accessible. Secure.

Features
IMAP Access and Hushmail for Outlook plug-in now available!
Email aliases available!
Just1Key Password Manager, v1.02
Download Hush Messenger! Free, Secure

Quicklinks
FAQ (Frequently Asked Questions)
Hushmail Affiliate Program
How Hushmail works
Contact Us

News
Hush Messenger reviewed on TechTV!

Hush Mail



>> Account Creation:

Now you must create your encryption keys.

To be really secure, encryption keys need to be random. Since a computer can't generate true random numbers by itself, you will need to provide random input

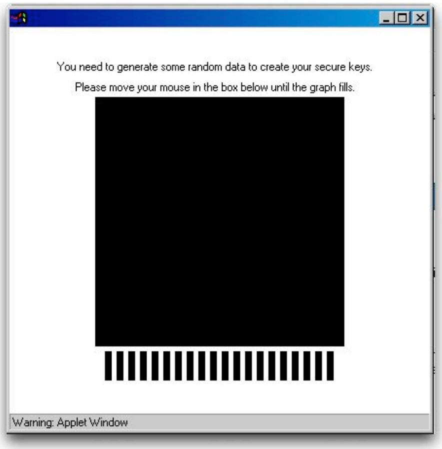
A window will appear which contains a black box and a graph. Move your mouse pointer around in that black box until the graph fills. The process will go more quickly if you move your mouse in a circular motion inside the box. Don't worry about trying to make your movements random; the tiny differences in motion that will happen naturally are just as good.

Click "Next" to generate your keys.

>> Steps:

1. Load the Hush Encryption Engine
2. Choose your username
3. Generate encryption keys
4. Choose your passphrase

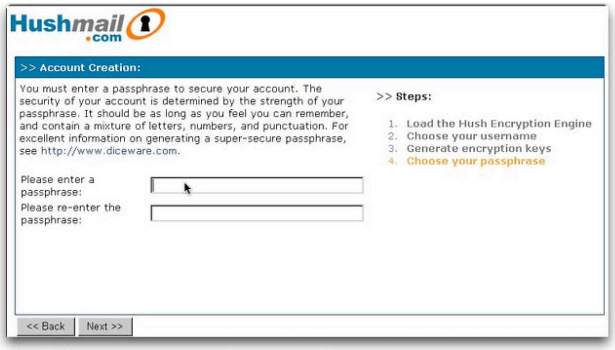
Hush Mail



You need to generate some random data to create your secure keys.

Please move your mouse in the box below until the graph fills.

Hush Mail



>> Account Creation:

You must enter a passphrase to secure your account. The security of your account is determined by the strength of your passphrase. It should be as long as you feel you can remember, and contain a mixture of letters, numbers, and punctuation. For excellent information on generating a super-secure passphrase, see http://www.diceware.com.

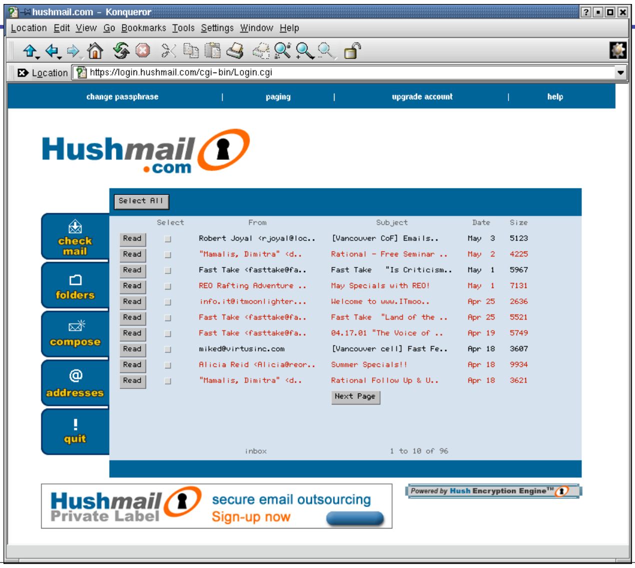
Please enter a passphrase:

Please re-enter the passphrase:

>> Steps:

1. Load the Hush Encryption Engine
2. Choose your username
3. Generate encryption keys
4. Choose your passphrase

Hush Mail Interface

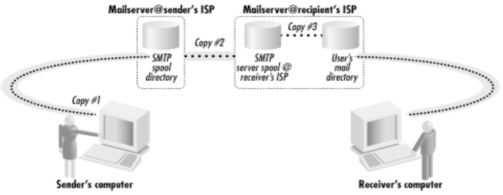


hushmail.com - Konqueror
Location Edit View Go Bookmarks Tools Settings Window Help
Location https://login.hushmail.com/cgi-bin/Login.cgi
change passphrase | paging | upgrade account | help
Hushmail.com
Select All
check mail
folders
compose
addresses
quit
Next Page
Hushmail Private Label
secure email outsourcing
Sign-up now
Powered by Hush Encryption Engine™

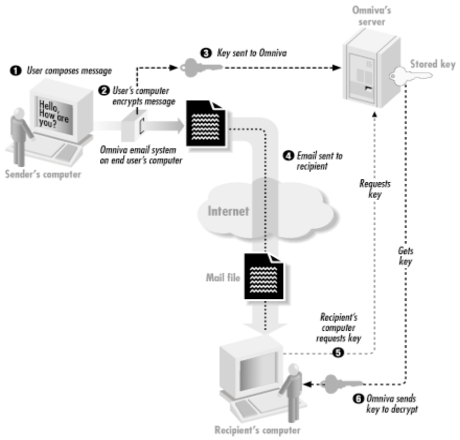
	Select	From	Subject	Date	Size
Read	□	Robert Joyal <rjoyal@loc..	[Vancouver CoF] Emails..	May 3	5123
Read	□	"Mamalis, Dimitra" <d..	Rational - Free Seminar ..	May 2	4225
Read	□	Fast Take <fasttake@fa..	Fast Take "Is Criticism..	May 1	5967
Read	□	REO Rafting Adventure ..	May Specials with REO!	May 1	7131
Read	□	info.it@itmoonlighter...	Welcome to www.ITmoo..	Apr 25	2636
Read	□	Fast Take <fasttake@fa..	Fast Take "Land of the ..	Apr 25	5521
Read	□	Fast Take <fasttake@fa..	04.17.01 "The Voice of ..	Apr 19	5749
Read	□	miked@virtusinc.com	[Vancouver cell] Fast Fe..	Apr 18	3607
Read	□	Alicia Reid <Alicia@reor..	Summer Specials!!	Apr 18	9934
Read	□	"Mamalis, Dimitra" <d..	Rational Follow Up & U..	Apr 18	3621

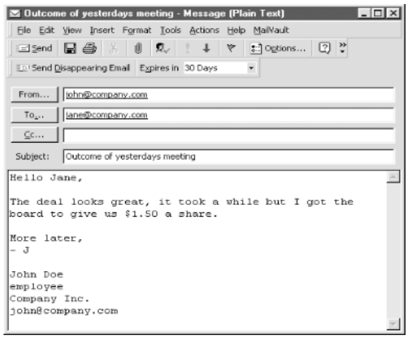
inbox 1 to 10 of 96

Email gets copies a lot; each copy can violate a person’s privacy.



Omniva encrypts email messages with a key that is deleted at a predetermined time.


Omniva's server
❸ Key sent to Omniva
Stored key
❶ User composes message
❷ User's computer encrypts message
Hello, How are you?
Omniva email system on end user's computer
Sender's computer
❹ Email sent to recipient
Requests key
Internet
Gets key
Mail file
Recipient's computer requests key
❺
❻ Omniva sends key to decrypt
Recipient's computer


Outcome of yesterdays meeting - Message (Plain Text)
File Edit View Insert Format Tools Actions Help MailVault
Send
Options...
Send Disappearing Email

Expires in 30 Days

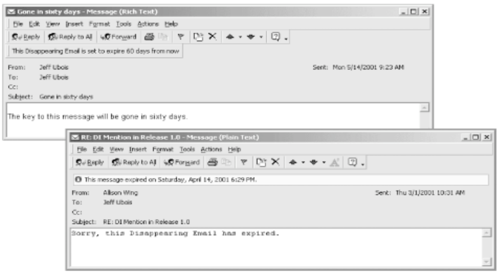
From... john@company.com

To... jane@company.com

Cc...

Subject: Outcome of yesterdays meeting

```
Hello Jane,

The deal looks great, it took a while but I got the
board to give us $1.50 a share.

More later,
- J

John Doe
employee
Company Inc.
john@company.com
```


Gone in sixty days - Message (Rich Text)
File Edit View Insert Format Tools Actions Help
Reply Reply to All Forward

This Disappearing Email is set to expire 60 days from now

From: Jeff Ubois
Sent: Mon 5/14/2001 9:23 AM
To: Jeff Ubois
Cc:
Subject: Gone in sixty days

The key to this message will be gone in sixty days.

RE: DI Mention in Release 1.0 - Message (Plain Text)
File Edit View Insert Format Tools Actions Help
Reply Reply to All Forward

This message expired on Saturday, April 14, 2001 6:29 PM.

From: Alison Wing
Sent: Thu 3/1/2001 10:31 AM
To: Jeff Ubois
Cc:
Subject: RE: DI Mention in Release 1.0

Sorry, this Disappearing Email has expired.

Mix-Nets, Web & IP transport

Chaum's mix-net scheme

The big idea: anonymity needs company

1 mix: you trust the mixer

More mixes -> Less Trust

Mixing needs to be in space and time

Key features of an anonymous remailer

Strips identity from messages passing through

Provides mapping of nyms to “true names”

- But only if replies are important

Optional:

- Mixing - only if traffic in and out is observable
- Encryption -

Anonymous Web Browsing

Web Caches

Anonymizer

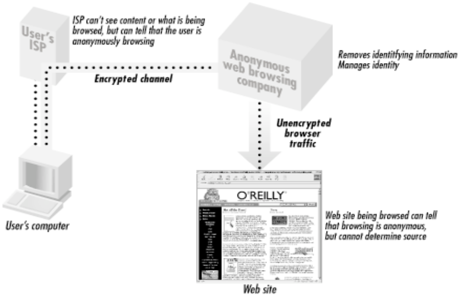
Anonymous Transport Services:

- Freedom
- Onion Routing

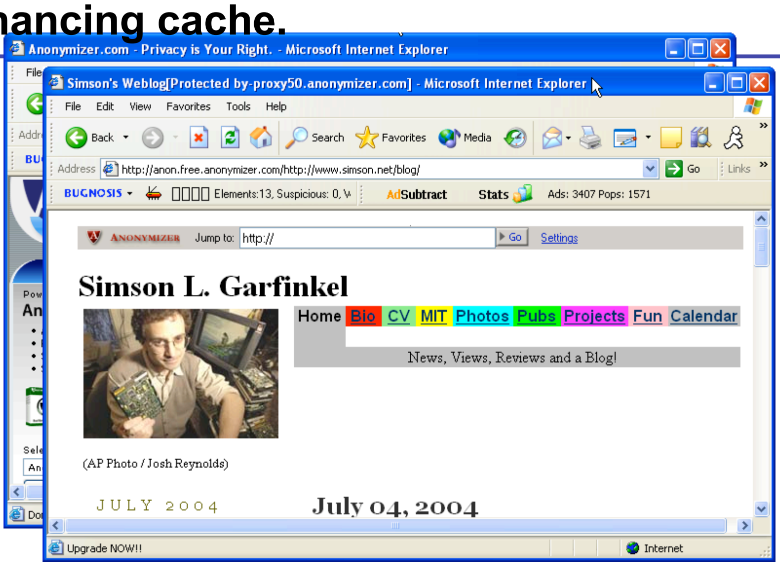
Web Caches provided low-cost privacy protection.

```
cache-ntc-ah12.proxy.aol.com - - [10/May/2003:22:47:31 -0400] "GET
/clips/1999.TR.LCS35-FountainOfIdeas.pdf HTTP/1.0" 200 65536
"http://aolsearch.aol.com/aol/search?query=fountain+ideas&page=2"
"Mozilla/4.0 (compatible; MSIE 6.0; AOL 7.0; Windows NT 5.1; .NET CLR
1.0.3705)“

cache-ntc-ah12.proxy.aol.com - - [10/May/2003:22:47:39 -0400] "GET
/clips/1999.TR.LCS35-FountainOfIdeas.pdf HTTP/1.1" 206 688128 "-"
"Mozilla/4.0 (compatible; MSIE 6.0; AOL 7.0; Windows NT 5.1; .NET CLR
1.0.3705)“

cache-ntc-ah12.proxy.aol.com - - [10/May/2003:22:47:44 -0400] "GET
/clips/1999.TR.LCS35-FountainOfIdeas.pdf HTTP/1.1" 206 1024 "-"
"Mozilla/4.0 (compatible; MSIE 6.0; AOL 7.0; Windows NT 5.1; .NET CLR
1.0.3705)“

cache-ntc-ah12.proxy.aol.com - - [10/May/2003:22:47:47 -0400] "GET
/clips/1999.TR.LCS35-FountainOfIdeas.pdf HTTP/1.1" 206 75 "-" "Mozilla/4.0
```

Third-party caches can make this technology widely available.


User's ISP
ISP can't see content or what is being browsed, but can tell that the user is anonymously browsing
Encrypted channel
Anonymous web browsing company
Removes identitfying information
Manages identity
Unencrypted browser traffic
User's computer
O'REILLY
Web site being browsed can tell that browsing is anonymous, but cannot determine source
Web site

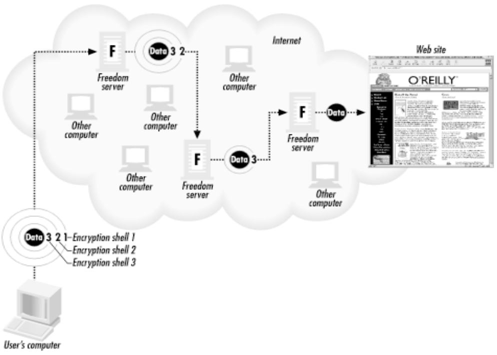
Anonymizer is a commercial privacy-enhancing cache.


Anonymizer.com - Privacy is Your Right. - Microsoft Internet Explorer
Simson's Weblog[Protected by-proxy50.anonymizer.com] - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://anon.free.anonymizer.com/http://www.simson.net/blog/
Go Links
BUGNOSIS Elements:13, Suspicious: 0, W
AdSubtract Stats Ads: 3407 Pops: 1571
ANONYMIZER Jump to: http:// Go Settings
Simson L. Garfinkel
Home Bio CV MIT Photos Pubs Projects Fun Calendar
News, Views, Reviews and a Blog!
(AP Photo / Josh Reynolds)
JULY 2004
July 04, 2004
Upgrade NOW!!
Internet

Anonymizer.com rewrites URLs

```
 <td width=90 style='background:aqua;
                     text-align:center; font:bold; font-family:Arial'>
      <a href='http://anon.free.anonymizer.com/http://www.simson.net/photos.php'
title='Photos by and of Simson Garfinkel'> Photos </a>
   </td>
   <td width=90 style='background:lime;
                     text-align:center; font:bold; font-family:Arial'>
      <a href='http://anon.free.anonymizer.com/http://www.simson.net/pubs.php'
title='Publications, both academic and journalistic.'> Pubs </a>
   </td>
    <td width=90 style='background:magenta;
                     text-align:center; font:bold; font-family:Arial'>
      <a href='http://anon.free.anonymizer.com/http://www.simson.net/projects.php'
title='Current projects'> Projects </a>
   </td>
```

Onion Routing (Freedom Network & others) provide anonymity at the IP level.



[Anonymous] Publication Systems can provide a different kind of anonymity.

Napster (1999 – 2001)

KaZaA ?

Freenet

Freehaven

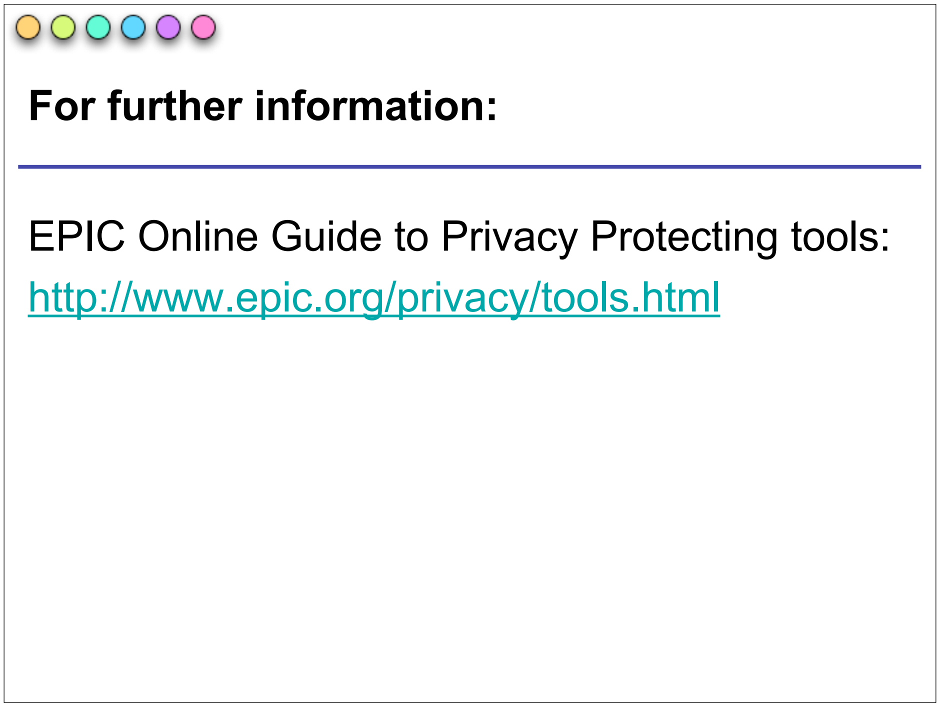
Downloads: Last Week : 821,951 Total : 389,392,921

Search. Download. Share. And now CALL!

Search for and download music, movies, games, software, images and documents.

Using Kazaa Safely

Read important information about using Kazaa safely. Click here.



For further information:

EPIC Online Guide to Privacy Protecting tools:
http://www.epic.org/privacy/tools.html