NetPGP
BSD-licensed Privacy

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Privacy?

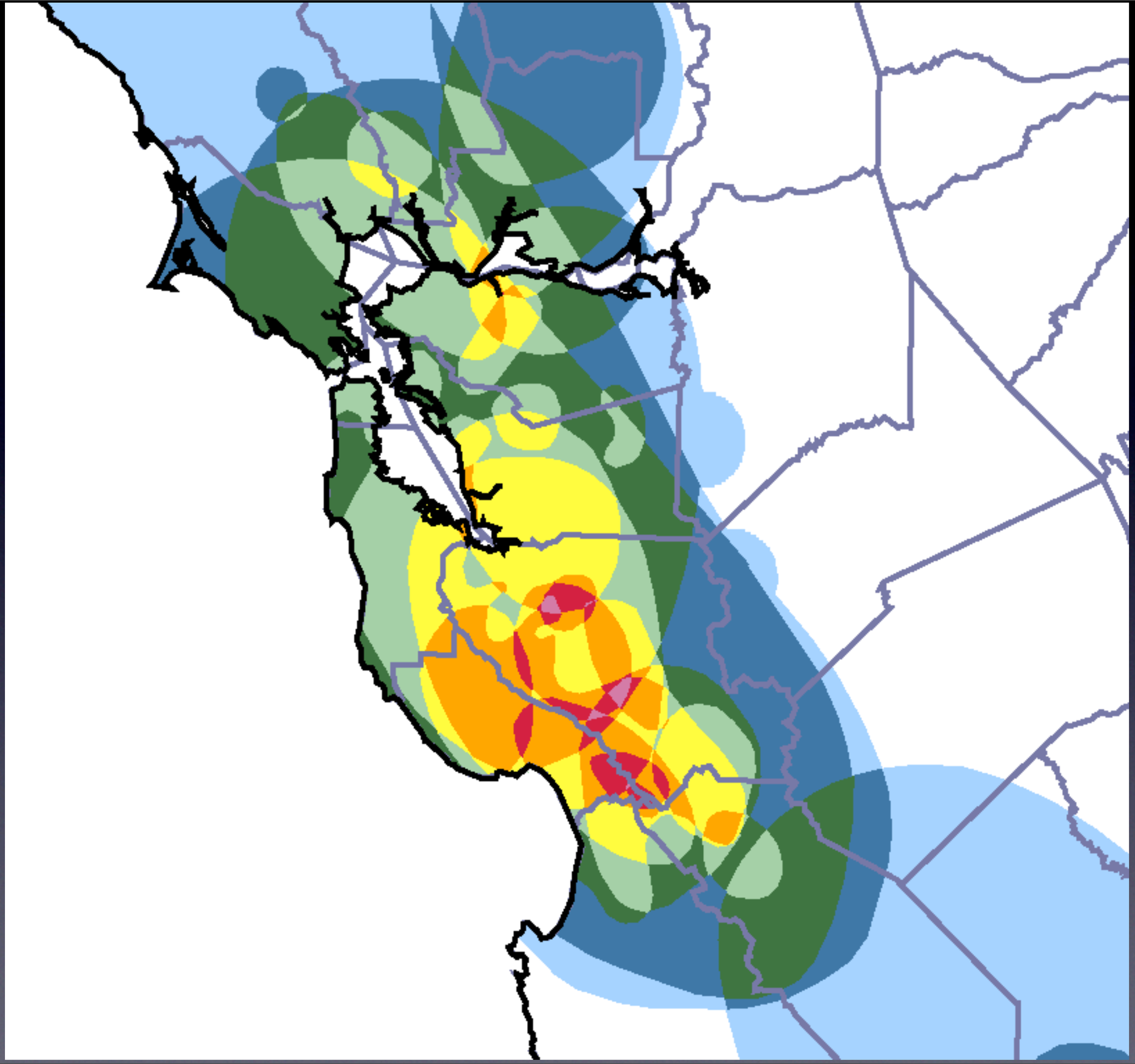
- Encryption and decryption
- Signing and verification
- Web of trust
- PKI
- Certifying Authority

Today?

- pgp
- gnupg
- gpgme
- proprietary privacy software

Requirements

- BSD-licensed
- Embeddable
- Performant
- Command line invocation without Ph.D.




CATS: ALL YOUR BASE ARE BELONG
TO US.
PROTOS.DK

Base

- openpgpsdk library - Ben Laurie & Rachel Wilmer
- decrypts files <= 8192 bytes
- verifies files <= 8192 bytes
- no detached signing or verification

OpenPGPSDK Structure

- 12 header files
- Masses of structs, functions, definitions
- No namespace limits or cues
- Large identifier names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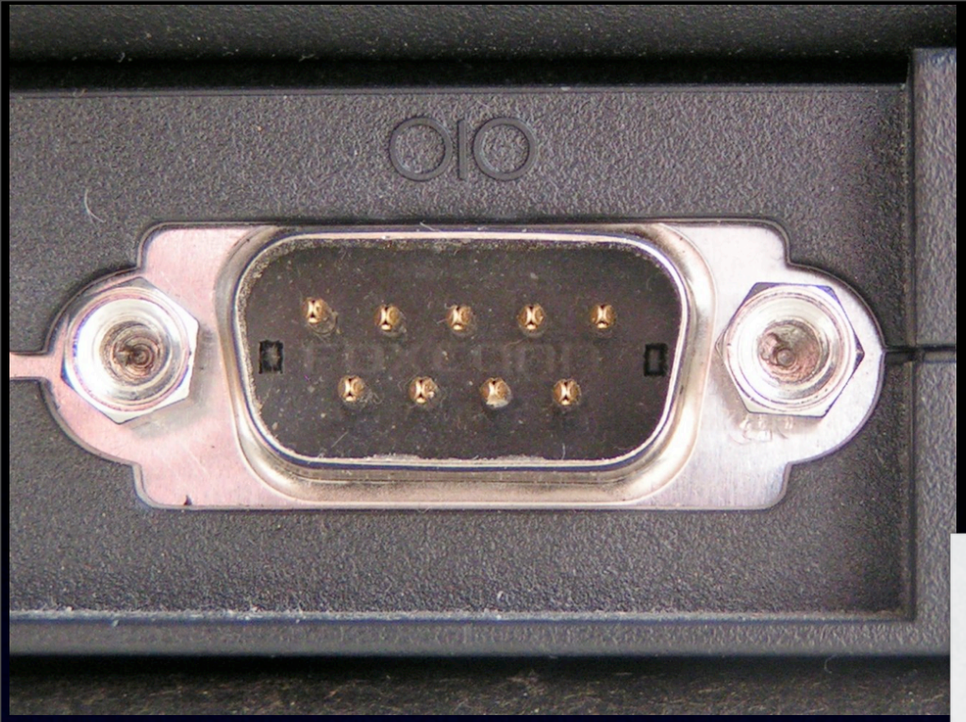
NetPGP

- Layer above OpenPGPSDK
- Hides openpgpsdk implementation
- One header file
- One structure used for state
- Configuration values by (key, value) strings

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Goals

- BSD-licensed embeddable library
- GPG compatibility

What is PGP?

- Based around IETF RFC 4880
  - describes PGP message format
  - obsoletes RFC 1991, 2440

How does it work?

- Two parts to key
  - public
  - private


MASTER
MINUTEMAN

PGP Signing and Verification

- File is signed with secret key of signer
- Can be verified with the public key of signer
- Proves provenance of file or stops file contents being disclosed


AUSTRALIA
Passport
1305
99
ECONOMY

Problems? Challenges?

- “I can’t use gpg”
  - I have problems too
    - It says more about gpg than me, though
- “Mail is OK, but everything else is hard”
  - Yes

PGP Encryption & Decryption

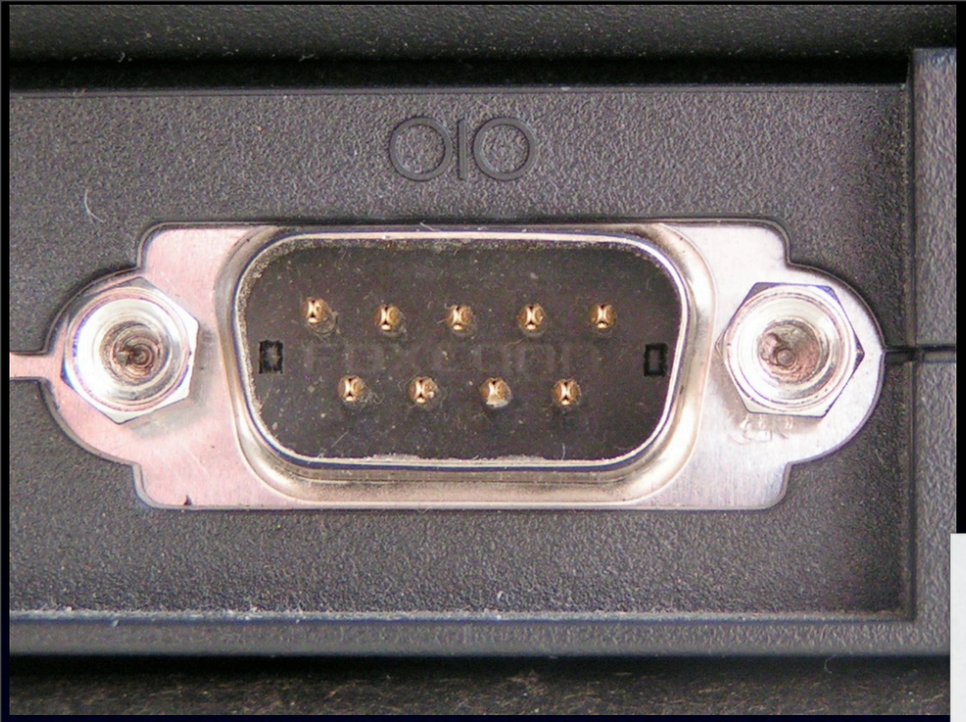
- File is encrypted with the public key
- Can only be decrypted with the secret key
- Corollary/complement of signing

Differentiators

- Why would I use netpgp over gpg?

Licensing

- BSD licensing
- Library can be used in places other libraries can’t reach
- Practical, usable signing and verification
- Encryption and decryption

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GPG compatible

- Use existing ~/.gnupg directory
- Use existing keys and configuration
- Use existing infrastructure for public keys
- Use files signed/encrypted by gpg

Library

- gpgme has problems
- embeddable anywhere
- could be added to existing programs

Language bindings

- Python
- Perl
- Lua
- C/C++

Split by functionality

- One binary for signing, verification, encryption and decryption
- One for key management
- Standalone binary for signature verification

Nantucket

Netpgp in Action

- Taken from portable regression test suite
- GNU auto tools tests not shown here

Sign 748579 byte file

```
% /usr/bin/netpgp --sign a
netpgp: default key set to "C0596823"
pub 2048/RSA (Encrypt or Sign) 1b68dcfcc0596823 2004-01-12
Key fingerprint: d415 9deb 336d e4cc cdfa 00cd 1b68 dcfc c059 6823
uid                  Alistair Crooks <agc@netbsd.org>
uid                  Alistair Crooks <agc@pkgsrc.org>
uid                  Alistair Crooks <agc@alistaircrooks.com>
uid                  Alistair Crooks <alistair@hockley-crooks.com>
netpgp passphrase:
%
```

Verify that Signature

```
% /usr/bin/netpgp --verify a.gpg
netpgp: default key set to "C0596823"
Good signature for a.gpg made Sat Sep 19 06:52:46 2009
using RSA (Encrypt or Sign) key 1b68dcfcc0596823
pub 2048/RSA (Encrypt or Sign) 1b68dcfcc0596823 2004-01-12
Key fingerprint: d415 9deb 336d e4cc cdfa 00cd 1b68 dcfc c059 6823
uid                  Alistair Crooks <alistair@hockley-crooks.com>
uid                  Alistair Crooks <agc@pkgsrc.org>
uid                  Alistair Crooks <agc@netbsd.org>
uid                  Alistair Crooks <agc@alistaircrooks.com>
%
```

Encrypt 13501 byte file

```
% /usr/bin/netpgp --encrypt b
netpgp: default key set to "C0596823"
%
```

Decrypt that file

```
% /usr/bin/netpgp --decrypt b.gpg
netpgp: default key set to "C0596823"
pub 2048/RSA (Encrypt or Sign) 1b68dcfcc0596823 2004-01-12
Key fingerprint: d415 9deb 336d e4cc cdfa 00cd 1b68 dcfc c059 6823
uid                  Alistair Crooks <agc@netbsd.org>
uid                  Alistair Crooks <agc@pkgsrc.org>
uid                  Alistair Crooks <agc@alistaircrooks.com>
uid                  Alistair Crooks <alistair@hockley-crooks.com>
netpgp passphrase:
%
```

```
% /usr/bin/netpgp --sign --detached f
netpgp: default key set to "C0596823"
pub 2048/RSA (Encrypt or Sign) 1b68dcfcc0596823 2004-01-12
Key fingerprint: d415 9deb 336d e4cc cdfa 00cd 1b68 dcfc c059 6823
uid                  Alistair Crooks <agc@netbsd.org>
uid                  Alistair Crooks <agc@pkgsrc.org>
uid                  Alistair Crooks <agc@alistaircrooks.com>
uid                  Alistair Crooks <alistair@hockley-crooks.com>
netpgp passphrase:
% ls -l f f.sig
-rw-r--r--  1 agc  agc  4491474 Sep 19 06:53 f
-rw-r--r--  1 agc  agc      287 Sep 19 06:53 f.sig
%
```

```
% /usr/bin/netpgp --verify f.sig
netpgp: default key set to "C0596823"
netpgp: assuming signed data in "f"
Good signature for f.sig made Sat Sep 19 06:53:06 2009
using RSA (Encrypt or Sign) key 1b68dcfcc0596823
pub 2048/RSA (Encrypt or Sign) 1b68dcfcc0596823 2004-01-12
Key fingerprint: d415 9deb 336d e4cc cdfa 00cd 1b68 dcfc c059 6823
uid                  Alistair Crooks <alistair@hockley-crooks.com>
uid                  Alistair Crooks <agc@pkgsrc.org>
uid                  Alistair Crooks <agc@netbsd.org>
uid                  Alistair Crooks <agc@alistaircrooks.com>
%
```

```
% '/usr/bin/netpgp' '--cat' 'a.gpg'
netpgp: default key set to "C0596823"
Good signature for a.gpg made Sat Sep 19 06:52:46 2009
using RSA (Encrypt or Sign) key 1b68dcfcc0596823
pub 2048/RSA (Encrypt or Sign) 1b68dcfcc0596823 2004-01-12
Key fingerprint: d415 9deb 336d e4cc cdfa 00cd 1b68 dcfc c059 6823
uid                 Alistair Crooks <alistair@hockley-crooks.com>
uid                 Alistair Crooks <agc@pkgsrc.org>
uid                 Alistair Crooks <agc@netbsd.org>
uid                 Alistair Crooks <agc@alistaircrooks.com>
%
```


Government of Canada
Gouvernement du Canada
Canada
2752-06368584-1
***723.60
01 DEC DEC 2004
AAFC
AAC
Pay to
Payez à
$*** 723.60
JOHN DOE
103-18 AURIGA DRIVE
NEPEAN
Ontario
Canada
K2E 7Z9
⑆00000⑈ 447⑆ 275206368584⑆

1+2=

Message digests

- Digital signatures are simply manipulation of a digest of a file using the secret key
- Problem with digest collisions
- Use of SHA2 instead of SHA1 for digests

Use Cases

Signed email

- Sign email with a digest - everyone can verify sender by using sender's public key
- PGP public keys available on key servers
- Compatible with gpg
  - except for the user interface

Signed software releases

- Projects usually sign the major releases
- People can verify that they have an official version

Signed Binaries

- Some embedded manufacturers use signed binaries to show provenance of binary
- Kernel will only execute a binary if it is known to come from reliable source

Signed backups

- To make sure that backups are good, they can be signed
- If anything changes, can be flagged
- Proves that backup was valid at one point in time

Well...

- Does a single signature prove the backup is good?

Multiple signatures

- Nested, or
- Detached signatures

Detached signatures

- Allow a file to remain unchanged
- Signature is in a separate file
- Any number of detached signatures can be made

Embedded signatures

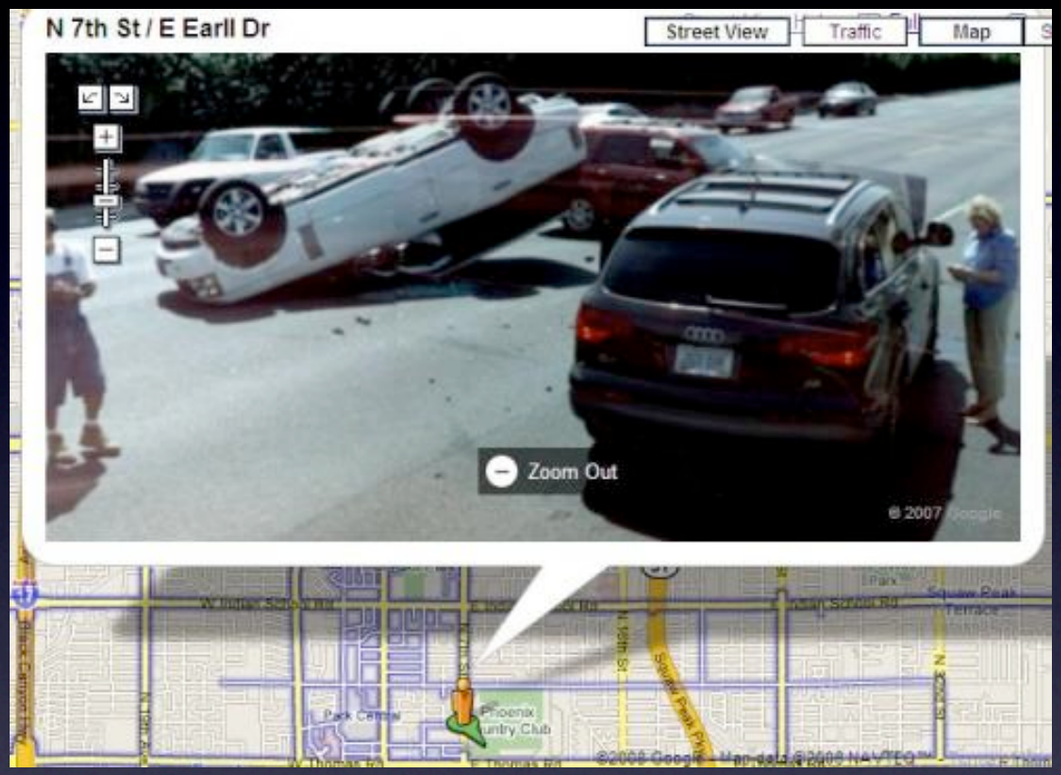
- Lack of symmetry
- Get contents of signed file
- After verification

Standalone Verification

- Separate program which verifies signature

Key Management

- Separate program which manages keys
- Not a priority
- Will list keys
- More development needed


N 7th St / E Earll Dr
Street View
Traffic
Map
Zoom Out
© 2007 Google
Phoenix Country Club
©2008 Google - Map data ©2008 NAVTEQ™

Multiple encryption

- How do we do this for multiple people to decrypt?
- Backup tapes, for example

Indirection

- By using a key to encrypt the backup tape
- And then giving that key to multiple parties, encrypted with their own key

Byzantine Generals

Byzantine refers to the Byzantine Generals' Problem, an agreement problem in which generals of the Byzantine Empire's army must decide unanimously whether to attack some enemy army. The problem is complicated by the geographic separation of the generals, who must communicate by sending messengers to each other, and by the presence of traitors amongst the generals. These traitors can act arbitrarily in order to achieve the following aims: trick some generals into attacking; force a decision that is not consistent with the generals' desires, e.g. forcing an attack when no general wished to attack; or confusing some generals to the point that they are unable to make up their minds. If the traitors succeed in any of these goals, any resulting attack is doomed, as only a concerted effort can result in victory.

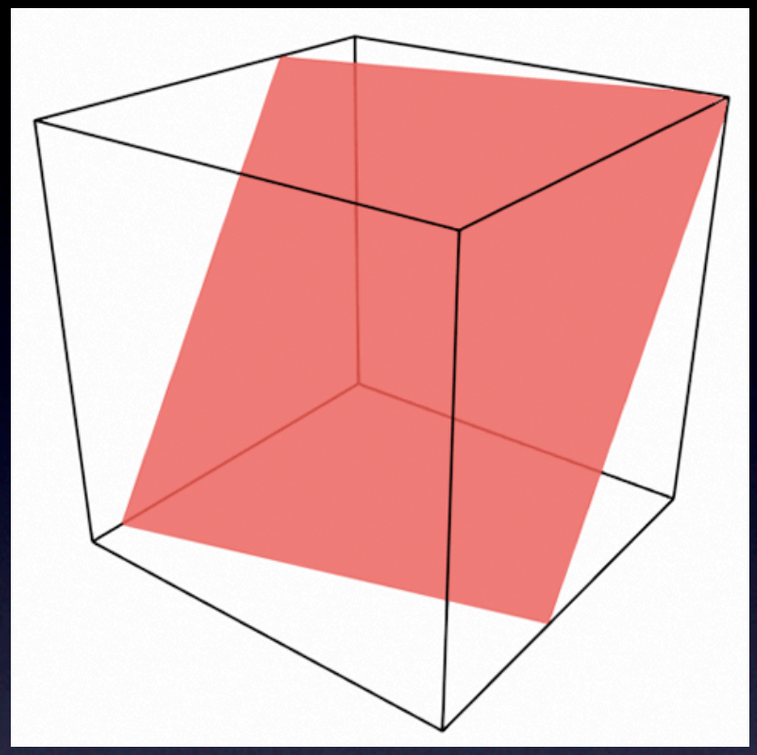
Byzantine fault tolerance can be achieved if the loyal (non-faulty) generals have a unanimous agreement on their strategy. Note that if the source general is correct, all loyal generals must agree upon that value. Otherwise, the choice of strategy agreed upon is irrelevant.

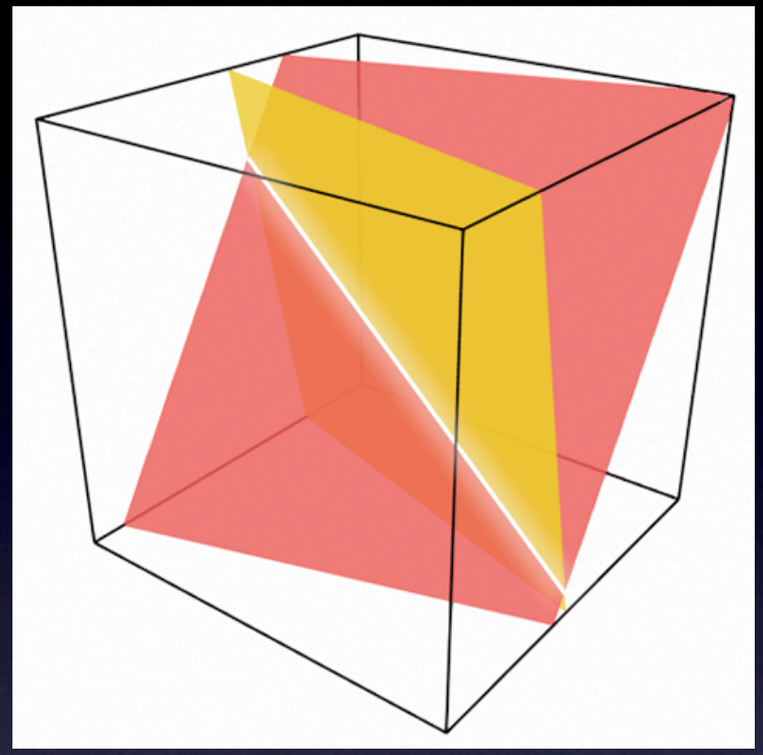
A different way...

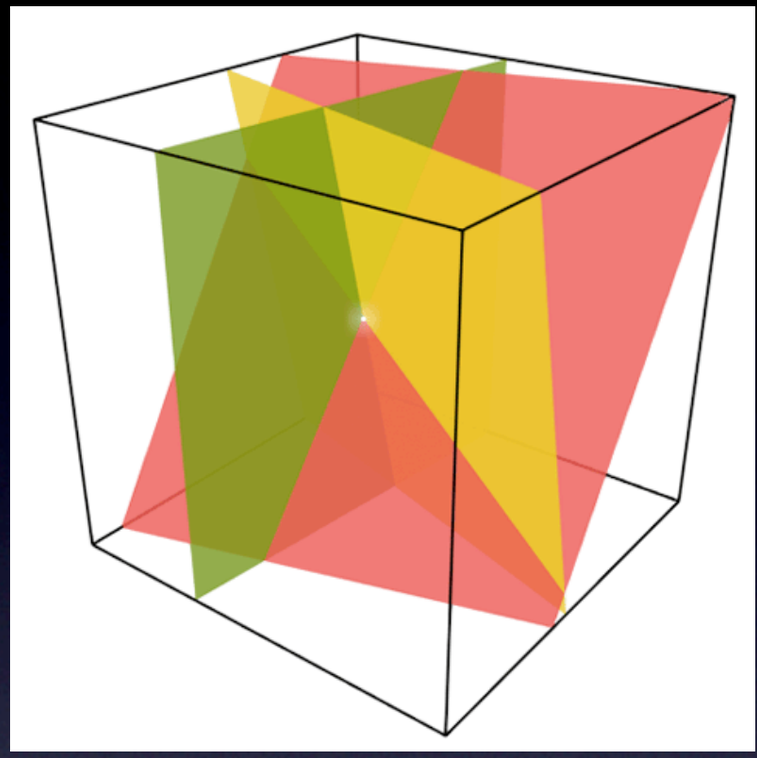
- Shamir's secret sharing scheme

Secret Sharing

- Shamir's Secret Sharing Scheme
- Multi-dimensional space
- Threshold schemes
- Byzantine fault tolerance







gnupg

Noteworthy changes in version 1.4.10 (2009-09-02)

2048 bit RSA keys are now generated by default.
The default hash algorithm preferences has changed to prefer SHA-256 over SHA-1.
2048 bit DSA keys are now generated to use a 256 bit hash algorithm

Benefits

- Don’t modify exec format
- Don’t modify binary
- Hang onto NetBSD’s veriexec insfrastructure

NetBSD & signed binaries

- Want to load signatures from userland
- Verify in kernel (only public key needed)
- Modify veriexec fromework to check verification of signature via pubkey

Thank you

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Questions?

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