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Visualizing Your Key for Secure Phone Calls and Language Independence

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Objective

- Problem Area
- Approach
- Discussion

Problem Area

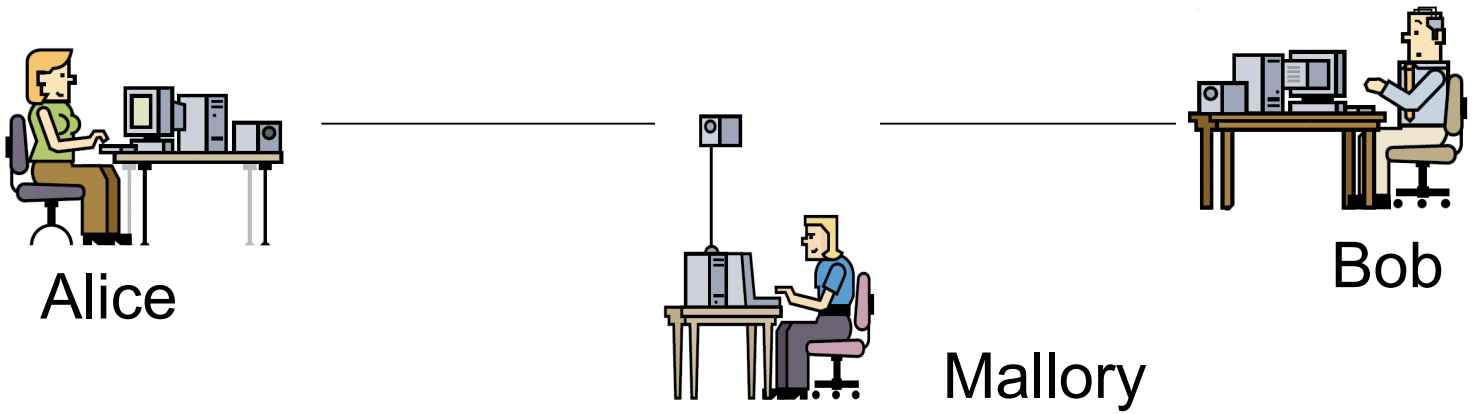
- Providing Security for Internet Protocols
  - Internet Phone Calls
    - Voice Over IP (VoIP) Security
      - SIP, SDP, RTP, DNS
    - Other secure voice/video systems
- Involve the user in the “security process”

Problem Area

- Passive
  - Eavesdropping
- Active Attacks
  - Flooding, VoIP Spam, Call Hijacking
  - **MITM**
- Implementation and Configuration Errors
  - Intentional and Unintentional
    - Leads to VoIP specific attacks

Problem Area

- To protect the media, the call requires
  - Confidentiality
    - Key negotiation
      - » **Authentication**



Images from:
Justin Mullins, "Making Unbreakable Code," IEEE Spectrum, pages 40-45, May 2002.

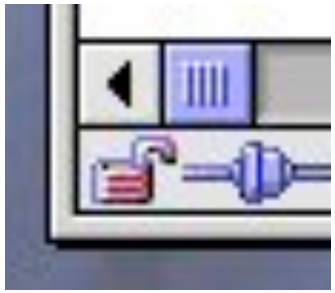
Problem Area

- Security as seen by the user
  - SSH
    - First Time: Blindly accept?

```
unix:~/.ssh mjo$ ssh -l mjo 192.168.1.3
The authenticity of host '192.168.1.3 (192.168.1.3)' can't be established.
RSA key fingerprint is 17:5e:bf:af:ce:44:d3:67:d9:f7:90:b0:55:fa:98:27.
Are you sure you want to continue connecting
```

Yes/No?

  - Web of Trust
  - HTTPS
    - PKI



Approach

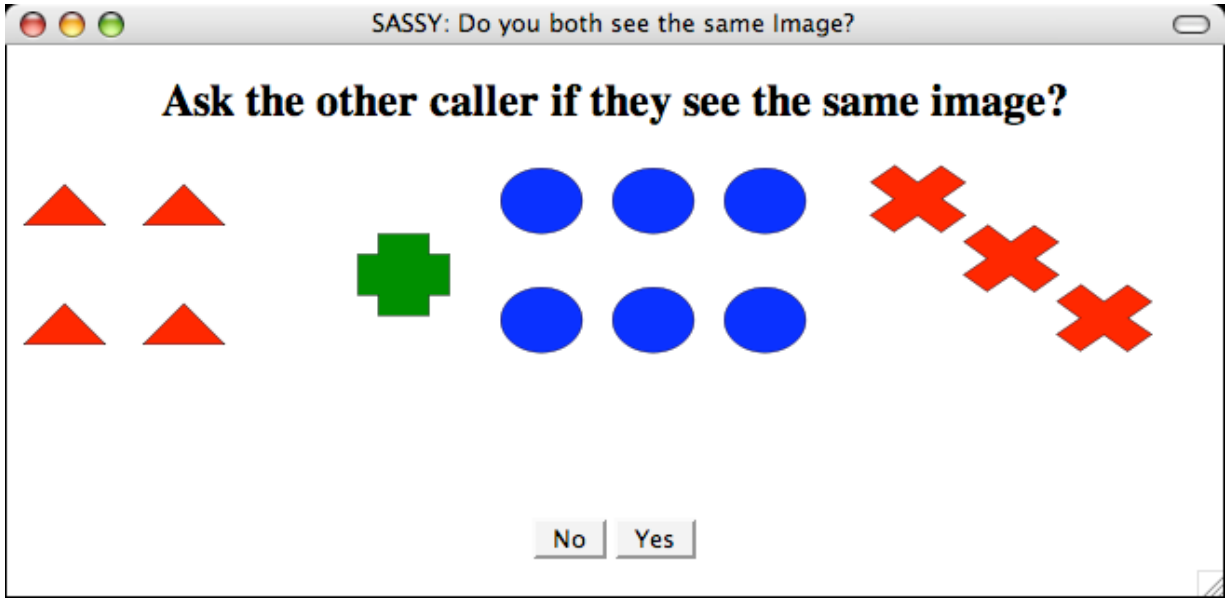
- How to Engage the user in security process?
  - Effective Mechanism
    - Based strong cryptography
  - Simple Mechanism
    - Without intricate knowledge of cryptography
    - Useful to all

Approach

- Securely derive a session key
  - Utilize a Key Management Protocol
- Derive visual encoding of the Secret key
  - Present an image on both systems
- The users then verbally confirm what they see
  - You recognize the caller's voice
  - You trust the caller

Approach

- Present a visual interface component
  - Basic geometric shapes, color, and count

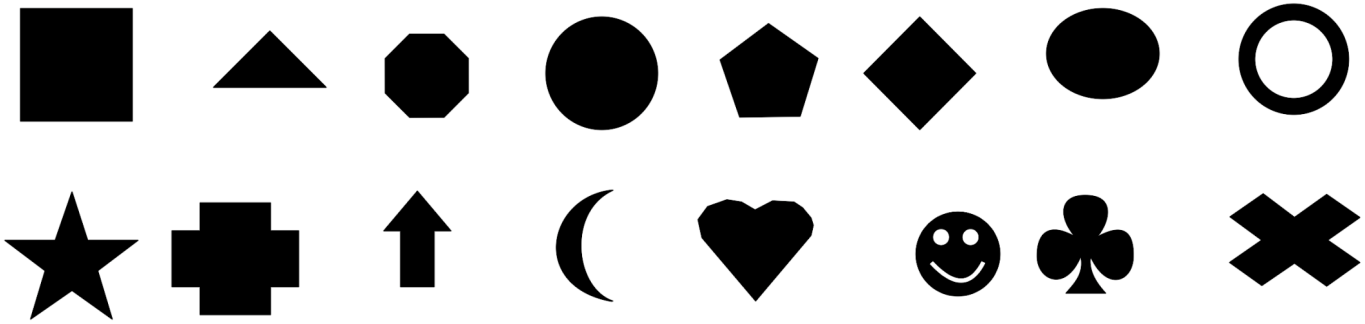


Approach

- Easily Identifiable
  - Color, count, and shape
- Independent of Language
- Lightweight Security Mechanism
- Applicable for caller's social network
  - Friends, family, colleagues

Approach

- 2 Sets of shapes, 4 Colors, 8 Arrangements



- Glyph for every byte

Discussion

- Side Channel Authentication
  - A mechanism and/or medium providing Authentication
    - That is not readily accessible to the adversary
      - And thus, not easily forged.
  - Mechanism
    - Art → PKI Certificate Representation,
    - Bar Code → Public Key
    - 3-Dimension Scene → Internet Transaction
  - Medium:
    - Visual, audio, Out-of-Band data network

Discussion

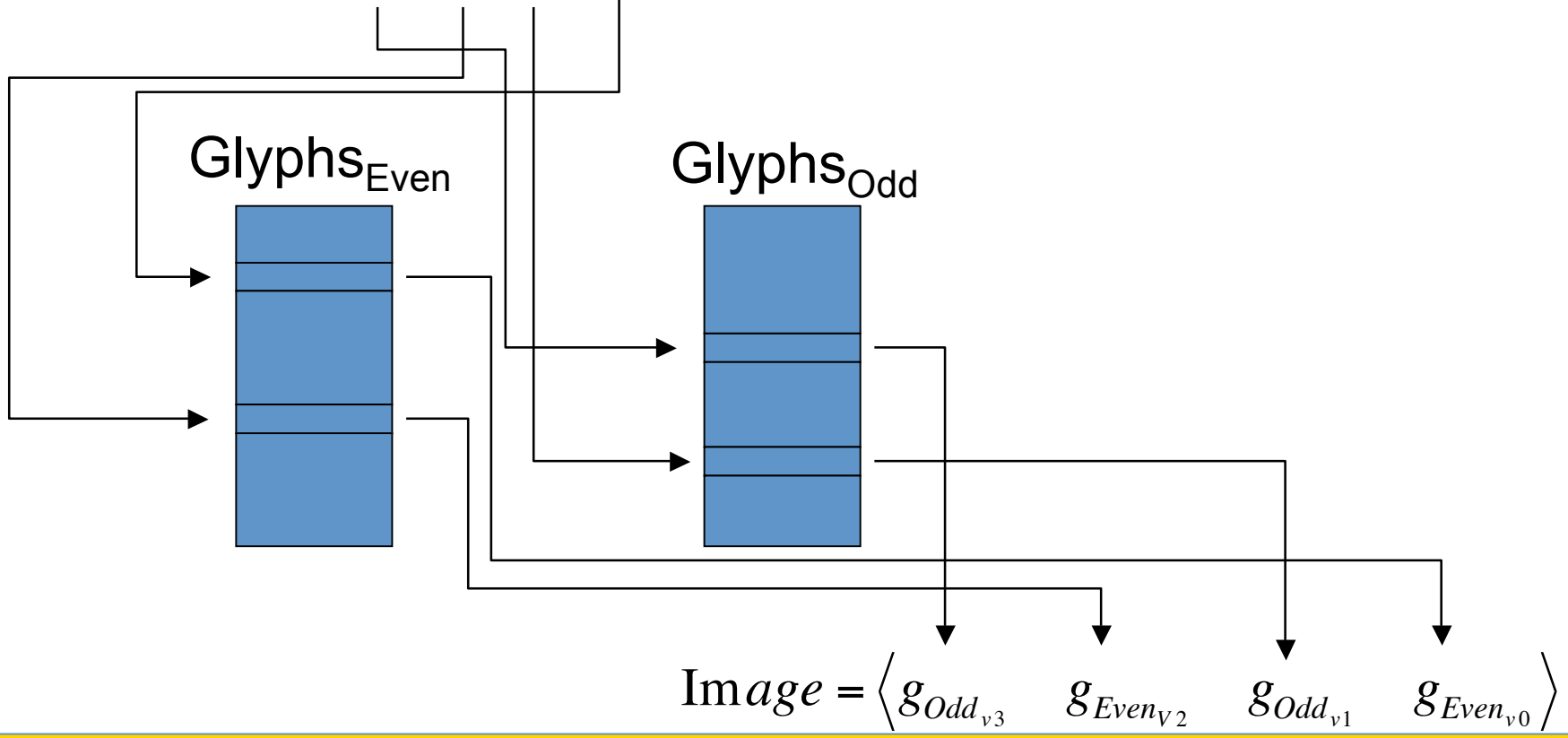
- AT&T TSD 3600, 1993
  - Read some bytes
- PGPfone, 1996
- ZRTP, 2010
  - Phil Zimmermann Real Time Protocol
  - “Short Authentication String”
  - English Only

- **Engage all users!**
  - **Leverage visualization**

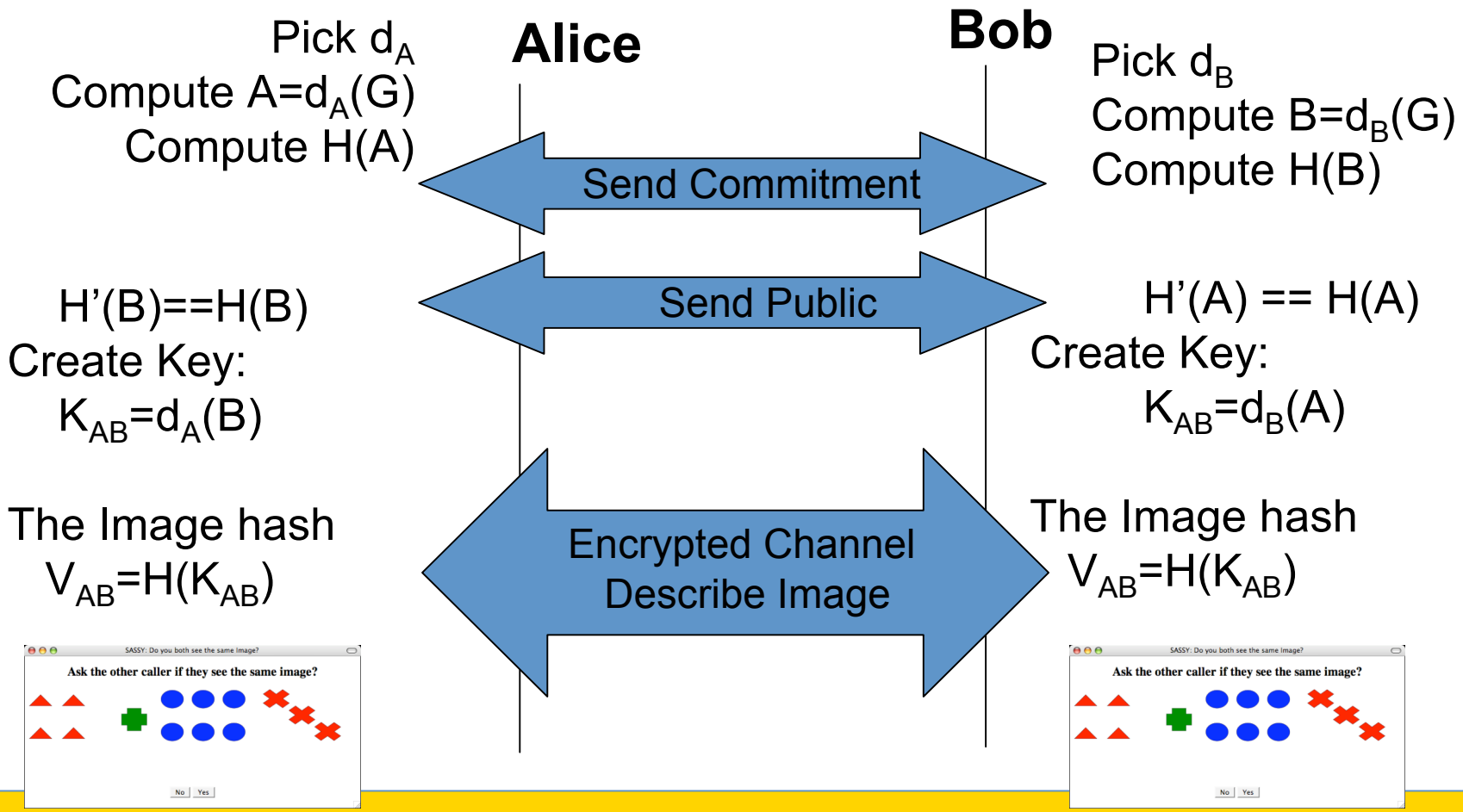
Discussion

Select Glyph from Alternate Sets

SHA(key) = <v_n, …,v_3, v_2, v_1, v_0>



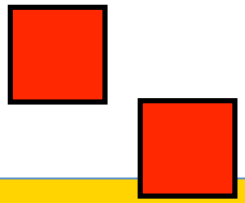
Discussion


Alice
Bob
Pick d_A
Compute $A=d_A(G)$
Compute $H(A)$
Pick d_B
Compute $B=d_B(G)$
Compute $H(B)$
Send Commitment
Send Public
$H'(B)==H(B)$
Create Key:
$K_{AB}=d_A(B)$
$H'(A) == H(A)$
Create Key:
$K_{AB}=d_B(A)$
The Image hash
$V_{AB}=H(K_{AB})$
Encrypted Channel
Describe Image
The Image hash
$V_{AB}=H(K_{AB})$
SASSY: Do you both see the same image?
Ask the other caller if they see the same image?
No
Yes
SASSY: Do you both see the same image?
Ask the other caller if they see the same image?
No
Yes

Discussion

- Prototype
  - Scaleable Vector Graphic (SVG)
    - Represent all combinations of images
    - Small Footprint

```
<desc>Two Red Square</desc>
<g transform="translate(16,8)">
<svg width="56px" height="56px">
<rect x='10' y='10' width='200' height='200' fill='Red' stroke='black' stroke-width='2' />
</svg>
</g>
    •••
```



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Discussion

- Observations
  - People “Get It”
  - Saw the rouse
  - Will they use?
  - Color Blind.

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Thanks

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