



Haojian Jin

# Where are we in the class?

- System
  - Location privacy
  - Permissions for Privacy
  - Policies for Privacy
- User
  - Privacy Norms/Contextual Integrity
  - Individual Privacy (CogSci)
  - User Agency
- Developer | Auditors
- ....

Human developers create risky computer systems that eventually affect human users.



# What is Agency

- The sense of agency is our experience of control of the world around us as we act in it [1].
- Do what you genuinely want to do. But it should not impact others negatively.

[1] Patrick Haggard and Manos Tsakiris. 2009. The Experience of Agency: Feelings, Judgments, and Responsibility. <https://doi.org/10.1111/J.1467-8721.2009.01644.X>

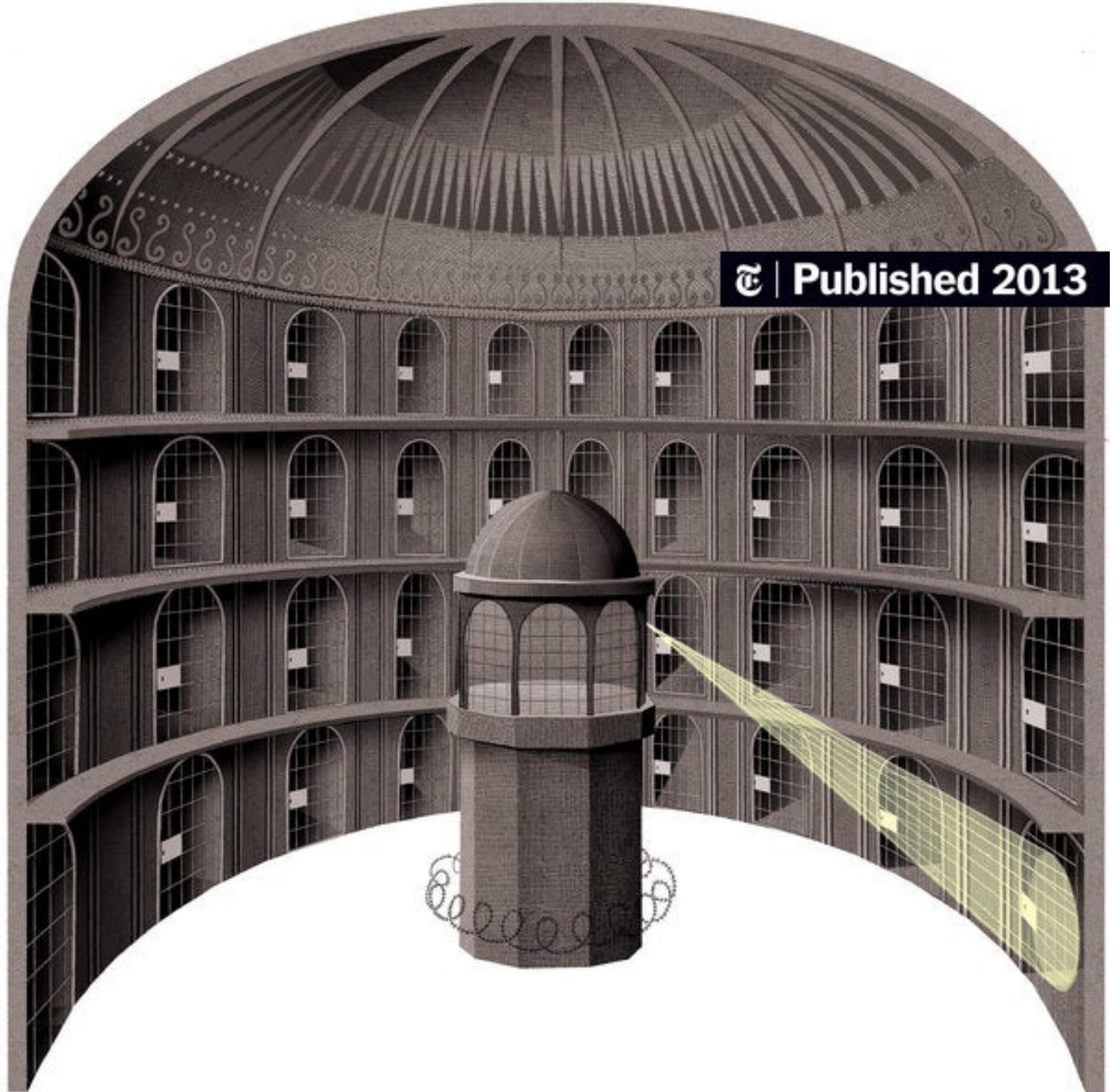
# Privacy and Agency

- Surveillance and agency
- Manipulation and behavioral influence
- AI-Participated decision making

## Surveillance and agency

Privacy enables individuals to make choices without external coercion or surveillance.

When people know their actions are being monitored, they may self-censor, leading to diminished autonomy and reduced willingness to explore certain behaviors or express themselves freely.



People modify their behavior simply due to the **possibility** of being watched.

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Check out [trending searches](#) over the last 24 hours.

## Trending searches in the last 24 hours

### Top 10 Name Searches

**1. "elon musk"**[Results](#)[See also](#)**2. "george soros"**[Results](#)[See also](#)**3. "tim%2bcook"**[Results](#)[See also](#)**4. "soros"**[Results](#)[See also](#)**5. "peter thiel"**[Results](#)[See also](#)**6. "donald trump"**[Results](#)[See also](#)**7. "john mcconnell"**[Results](#)[See also](#)**8. "elon%2bmusk"**[Results](#)[See also](#)**9. "bill gates"**[Results](#)[See also](#)**10. "mark zuckerberg"**[Results](#)[See also](#)

### Top 10 Employer Searches

**1. "aldi"**[Results](#)[See also](#)**2. "reddit"**[Results](#)[See also](#)**3. "the carlyle group"**[Results](#)[See also](#)**4. "comcast"**[Results](#)[See also](#)**5. "ingles"**[Results](#)[See also](#)**6. "general atomics"**[Results](#)[See also](#)**7. "bass pro"**[Results](#)[See also](#)**8. "black rifle"**[Results](#)[See also](#)**9. "new york times"**[Results](#)[See also](#)**10. "apple"**[Results](#)[See also](#)

### Top 10 Recipient Searches

**1. "trump"**[Results](#)[See also](#)**2. "harris"**[Results](#)[See also](#)**3. "donald trump "**[Results](#)[See also](#)**4. "israel"**[Results](#)[See also](#)**5. "donald trump"**[Results](#)[See also](#)**6. "biden"**[Results](#)[See also](#)**7. "norpac"**[Results](#)[See also](#)**8. "wendy davis"**[Results](#)[See also](#)**9. "kamala harris"**[Results](#)[See also](#)**10. "mccaul"**[Results](#)[See also](#)[Try your own search](#)

# One step further

The political party you support wants to collect information about how individuals feel about various issues and candidates, in order to campaign more effectively. They create a website and ask their supporters, including you, to enter the names of people you know along with any information you have about their political leanings. For example, the website suggests that you enter the political orientation of your neighbors based on campaign signs you see displayed in their yards, and that you enter relevant information you glean from personal discussions with people you know.

# Privacy and Surveillance is a Spectrum

- Factors:
  - How important the privacy is?
  - How strong my will is?
  - What will happen if I lose my privacy?
  - The likelihood of being watched?

# A strong argument against “I have nothing to hide”

- While I have nothing to hide, I want to protect others who need to hide.
  - Whistleblowers in organizations
  - Investigative journalists
  - ...

# Systems for Big brother privacy

1. Basic cryptographic concepts
2. Protocols for Anonymous Communication
3. Surveillance is about power relationship.



## **DATASHARENETWORK: A Decentralized Privacy-Preserving Search Engine for Investigative Journalists**

Kasra Edalatnejad and Wouter Lueks, *EPFL*; Julien Pierre Martin; Soline Ledésert, Anne L'Hôte, and Bruno Thomas, *ICIJ*; Laurent Girod and Carmela Troncoso, *EPFL*

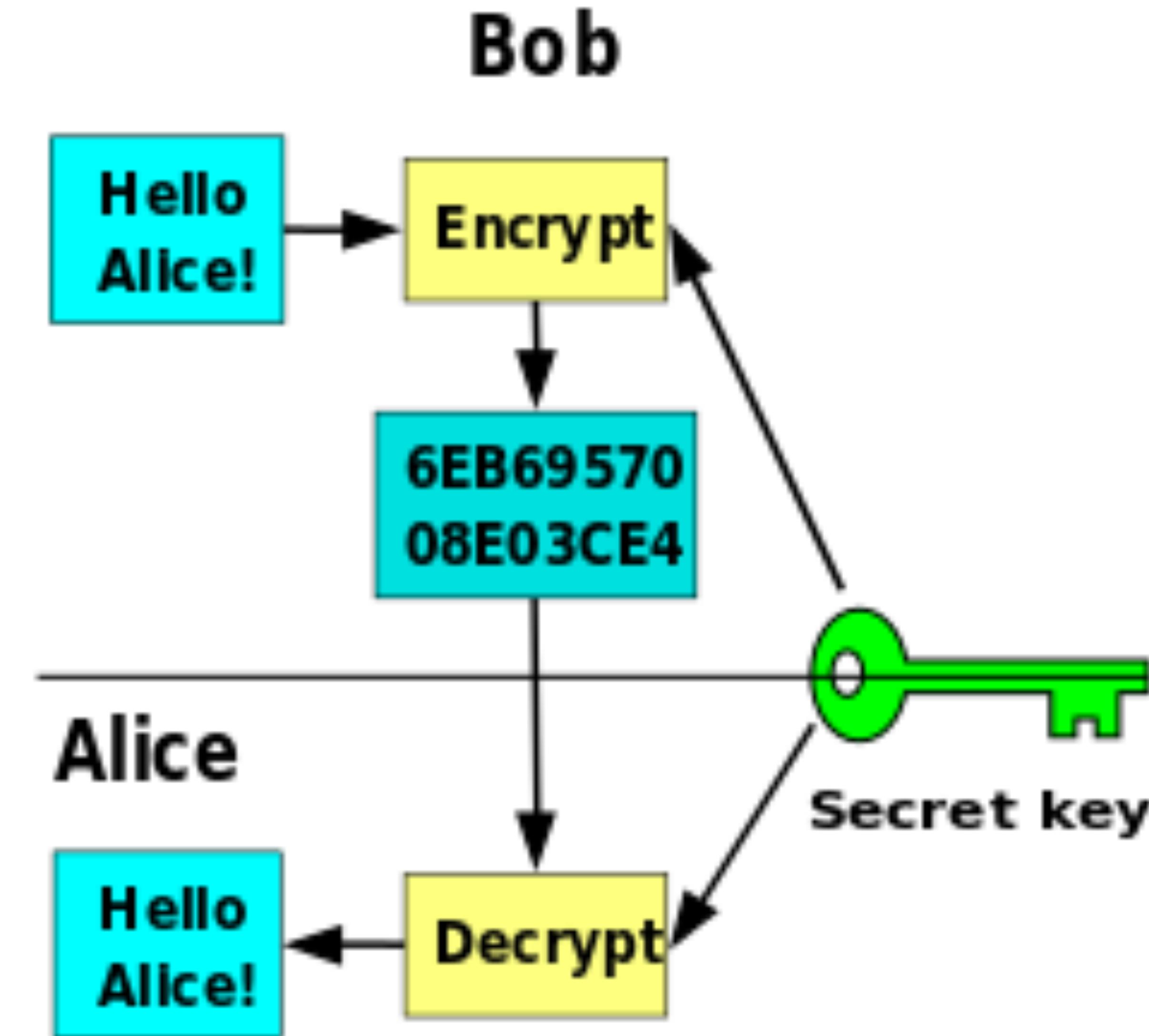
<https://www.usenix.org/conference/usenixsecurity20/presentation/edalatnejad>

# Basic Cryptographic Concepts

1. Encryption scheme (symmetric and public key)
2. Signature scheme
3. Hash function

# Symmetric Encryption Scheme

1. Key generation algorithm
  1. Produces a key that is used for encryption and decryption
  2. Algorithm to encrypt a message
  3. Algorithm to decrypt a ciphertext
4. Correctness:
  1. Decrypting a ciphertext obtained by encrypting message  $m$  with the corresponding key  $k$  returns  $m$ :  $\text{dec}(\text{enc}(m,k),k) = m$
5. (Symbolic) Security:
  1. A ciphertext cannot be decrypted without access to the key



# Public-Key Encryption Scheme

## 1. Key generation algorithm

1. Produces **private decryption & public encryption key pair**
2. Algorithm to encrypt a message
3. Algorithm to decrypt a ciphertext
4. Correctness:

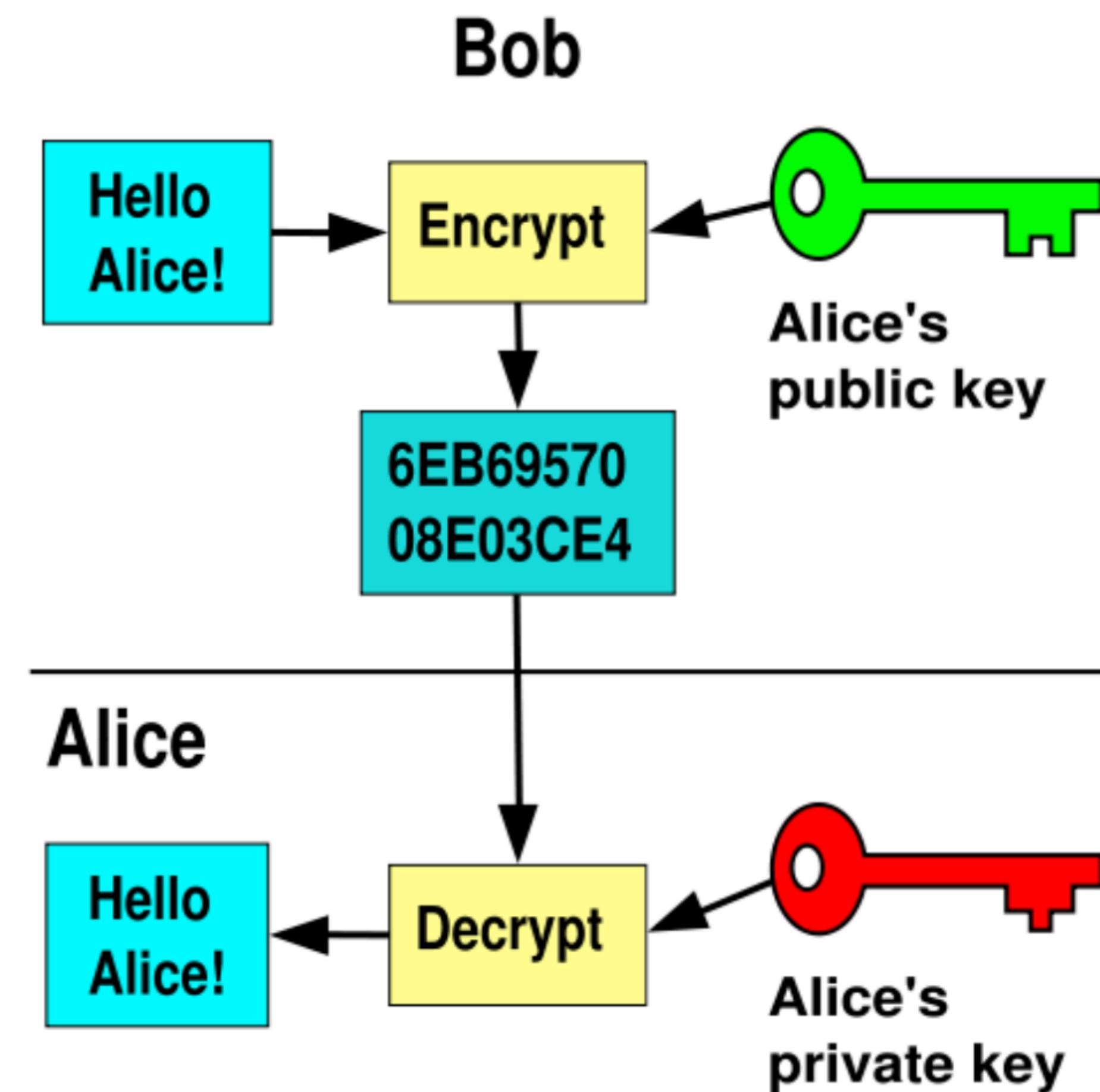
1. Decrypting a ciphertext obtained by encrypting message  $m$  with the corresponding key  $k$  returns  $m$ :

$$1. \text{dec}(\text{enc}(m, \text{pk}(A)), \text{sk}(A)) = m$$

## 5. (Symbolic) Security:

1. A ciphertext cannot be decrypted without access to the private key

# Public-Key Encryption Scheme



$$\text{dec}(\text{enc}(m,k),k) = m$$

$$\text{dec}(\text{enc}(m,\text{pk}(A)), \text{sk}(A)) = m$$

Categories	Symmetric key Cryptography	Asymmetric key Cryptography
Key used for encryption /decryption	Same key is used for encryption & decryption.	One key is used for encryption & another different key is used for decryption.
Key process	$\text{Ke}=\text{Kd}$	$\text{Ke} \neq \text{Kd}$
Speed of encryption/decryption	Very fast	Slower
Size of resulting encrypted text	Usually same as or less than the original clear text size.	More than the original clear text size.
Key agreement/exchange	A big problem	No problem at all.
Usage	Mainly used for encryption and decryption, cannot be used for digital signatures.	Can be used for encryption and decryption as well as for digital signatures.
Efficiency in usage	Symmetric key cryptography is often used for long messages.	Asymmetric key cryptography are more efficient for short messages.

# Signature Scheme

1. Key generation algorithm
  1. Produces **private signing** & **public verification** key pair
2. Algorithm to sign a message
3. Algorithm to verify a ciphertext
4. Correctness:
  1. Decrypting a ciphertext obtained by encrypting message  $m$  with the corresponding key  $k$  returns  $m$ :
    1. **verify( $m$ ,  $\text{sign}(m, \text{sk}(A))$ ,  $\text{pk}(A)$ ) = ok**
5. (Symbolic) Security:
  1. A signature cannot be decrypted without access to the private signing key

# Hash Functions

1. Key generation algorithm
  1. Produces a key
2. Algorithm to hash a message  $m$ , given a key  $k$  to a fixed length output  $\text{hash}(k, m)$
3. Security (Collision resistance)
4. Given hash function  $\text{hash}: X \rightarrow Y$  and key  $k$ , cannot find a collision, i.e.  $x, x' \in X$  s.t.  $x \neq x'$  and  $\text{hash}(k, x) = \text{hash}(k, x')$

[File](#) [Settings](#) [Help](#)

## NoVirusThanks MD5 Checksum Tool

[Like](#)[Tweet](#)[File Checksum](#)[Verify Checksum](#)[Compare Files](#)[Scan Folder](#)[String Hash](#)

Select file to compute hash checksum:

C:\Users\Dev\Desktop\MD5 Checksum Tool.lnk

[Browse...](#)[Hash](#)

100%

File size:

1,03 KB (1.056 bytes)

 SHA256 checksum:

A287A94F1D8184A230CD62A9911D5AFF29E75CE0FA9

 MD5 checksum:

C7B7E141EE5EF9AEFD5827C676B613BA

 SHA384 checksum:

B5BC9F9CF3691AD071CC4DE8A13813C6FB7A4B78B6

 SHA1 checksum:

B97A8FA3EB8BE98F1F3E71238B2888532BCA4F83

 SHA512 checksum:

295841698718C4C2932A430A906935DB56C26FB0D23

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# Privacy on Public Networks

1. Internet is designed as a public network
  1. Machines on your LAN may see your traffic, network routers see all traffic that passes through them
2. Routing information is public
  1. IP packet headers identify source and destination.
  2. Even a passive observer can easily figure out **who is talking to whom**
3. Encryption does not hide identities
  1. Encryption hides payload, but not routing information.
  2. Even IP-level encryption (tunnel-mode IPSec/ESP) reveals IP addresses of IPSec gateways

# Applications of Anonymity (I)

- **Privacy**
  - Hide online transactions, Web browsing, etc. from intrusive governments, marketers and archivists
- **Untraceable electronic mail**
  - Corporate whistle-blowers
  - Political dissidents
  - Socially sensitive communications (online A A meeting)
  - Confidential business negotiations
- **Law enforcement and intelligence**
  - Sting operations and honeypots
  - Secret communications on a public network

# Applications of Anonymity (2)

- Digital cash
  - Electronic currency with properties of paper money (online purchases unlinkable to buyer's identity)
- Anonymous electronic voting
- Censorship-resistant publishing

# What is Anonymity?

- Anonymity is the state of being not identifiable within a set of subjects
  - You cannot be anonymous by yourself!
  - Hide your activities among others' similar activities
- Unlinkability of action and identity
  - For example, sender and his email are no more related after observing communication than they were before
- Unobservability (hard to achieve)
  - Any item of interest (message, event, action) is indistinguishable from any other item of interest

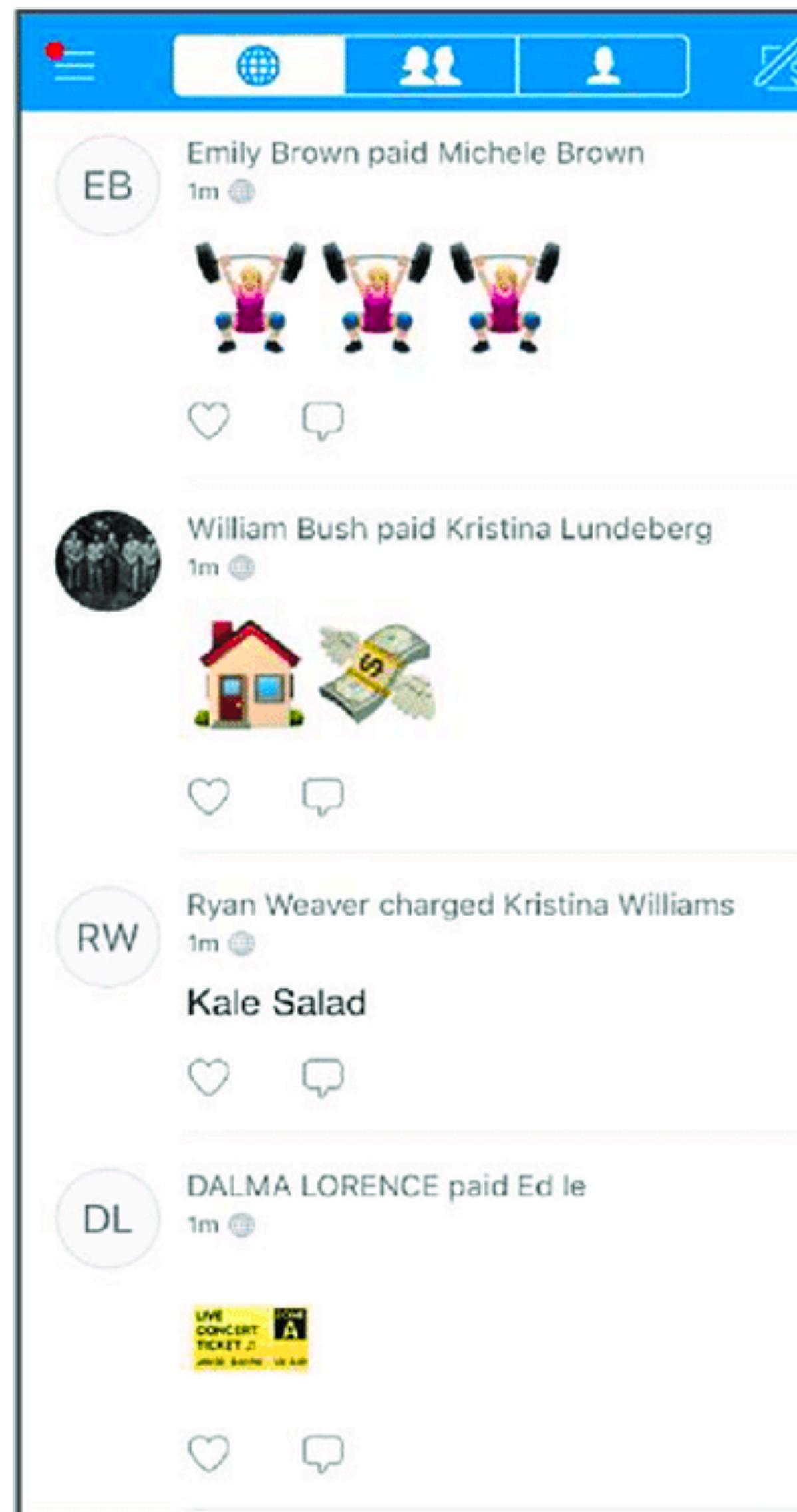
# Attacks on Anonymity

- **Passive traffic analysis**
  - Infer from network traffic who is talking to whom
  - To hide your traffic, must carry other people's traffic!
- **Active traffic analysis**
  - Inject packets or put a timing signature on packet flow
- **Compromise of network nodes**
  - Attacker may compromise some routers
  - It is not obvious which nodes have been compromised
    - Attacker may be passively logging traffic
  - Better not to trust any individual router
    - Assume that some fraction of routers is good, don't know which

# Systems

- Chaum Mixes
- Onion Routing
- Tor

# Chaum Mixes



## Privacy

← Learn More About Privacy

### DEFAULT PRIVACY SETTINGS

Select your default privacy option for all future payments. You can also change it for each payment individually.

- Public**  Visible to everyone on the internet
- Friends**  Visible to sender, recipients, and their friends
- Private**  Visible to sender and recipient only

MORE

- Past Transactions**

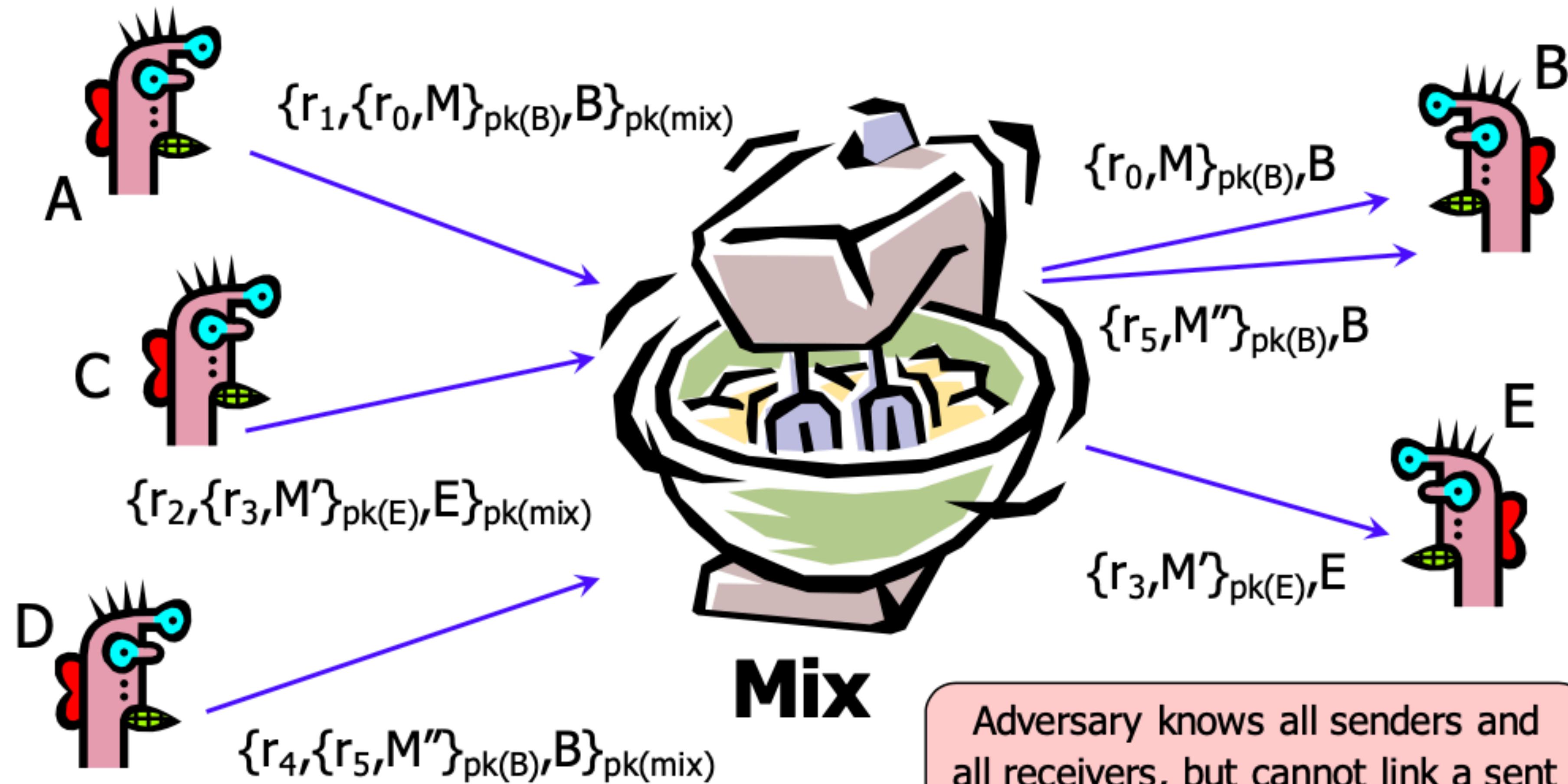
# Chaum Mixes



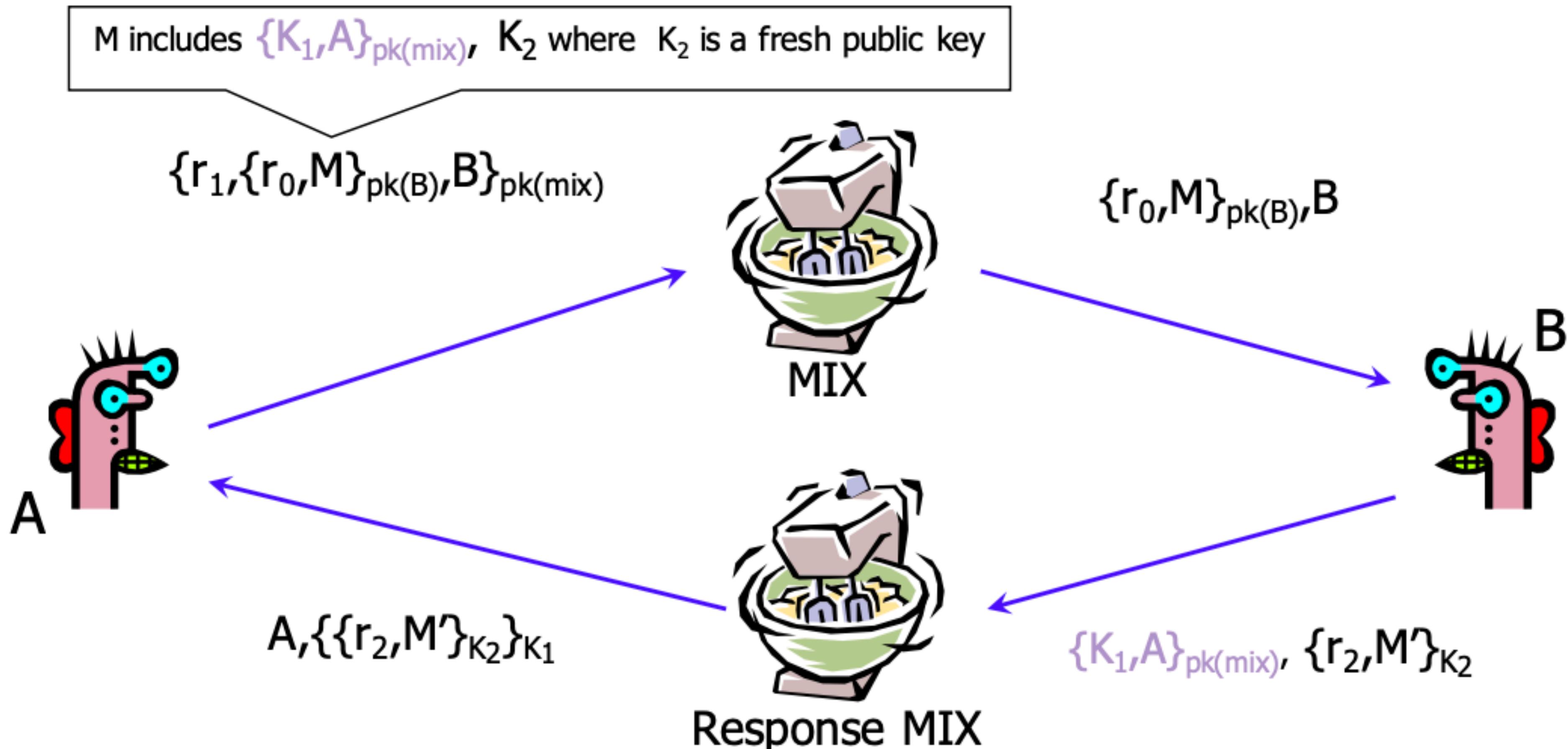
# Chaum Mixes

- Early proposal for anonymous email
  - David Chaum. “Untraceable electronic mail, return addresses, and digital pseudonyms”. Communications of the ACM, February 1981.
  - **Before spam, people thought anonymous email was a good idea**
- Public key crypto + trusted re-mailer (Mix)
  - Untrusted communication medium
  - Public keys used as persistent pseudonyms
- Emails, eCash, Blog posts, ...

# Basic Mix Design



# Anonymous Return Addresses



# Mix Cascade



- Messages are sent through a sequence of mixes
  - Can also form an arbitrary network of mixes ("mixnet")
- Some of the mixes may be controlled by attacker, but even a single good mix guarantees anonymity
- **Pad and buffer** traffic to foil correlation attacks

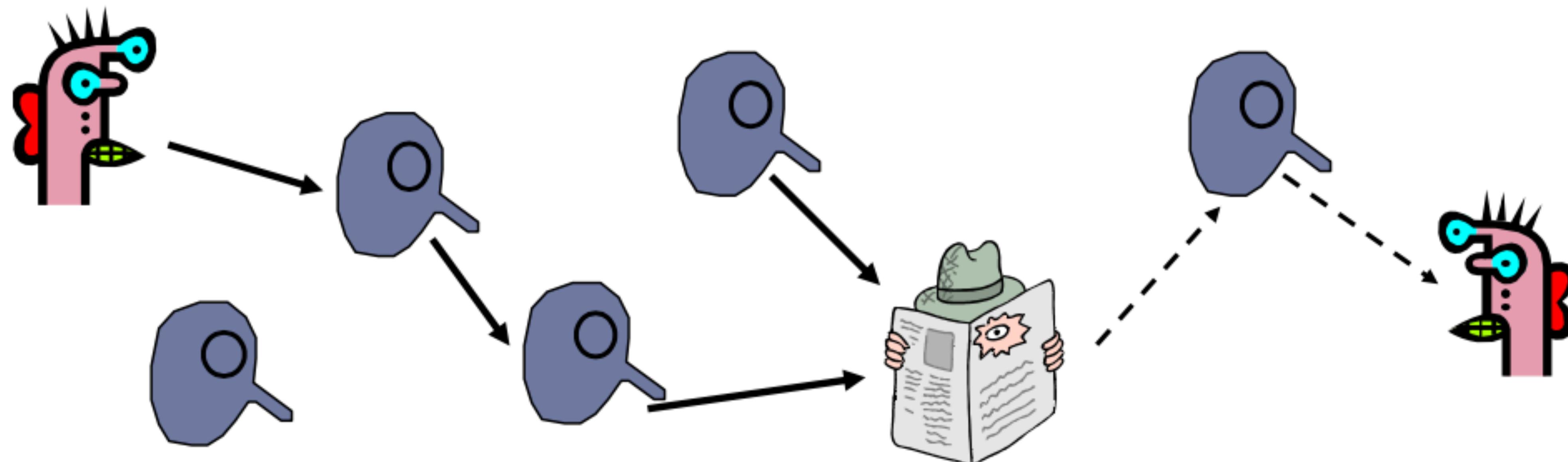
# How Mixnets work



# How Mixnets work

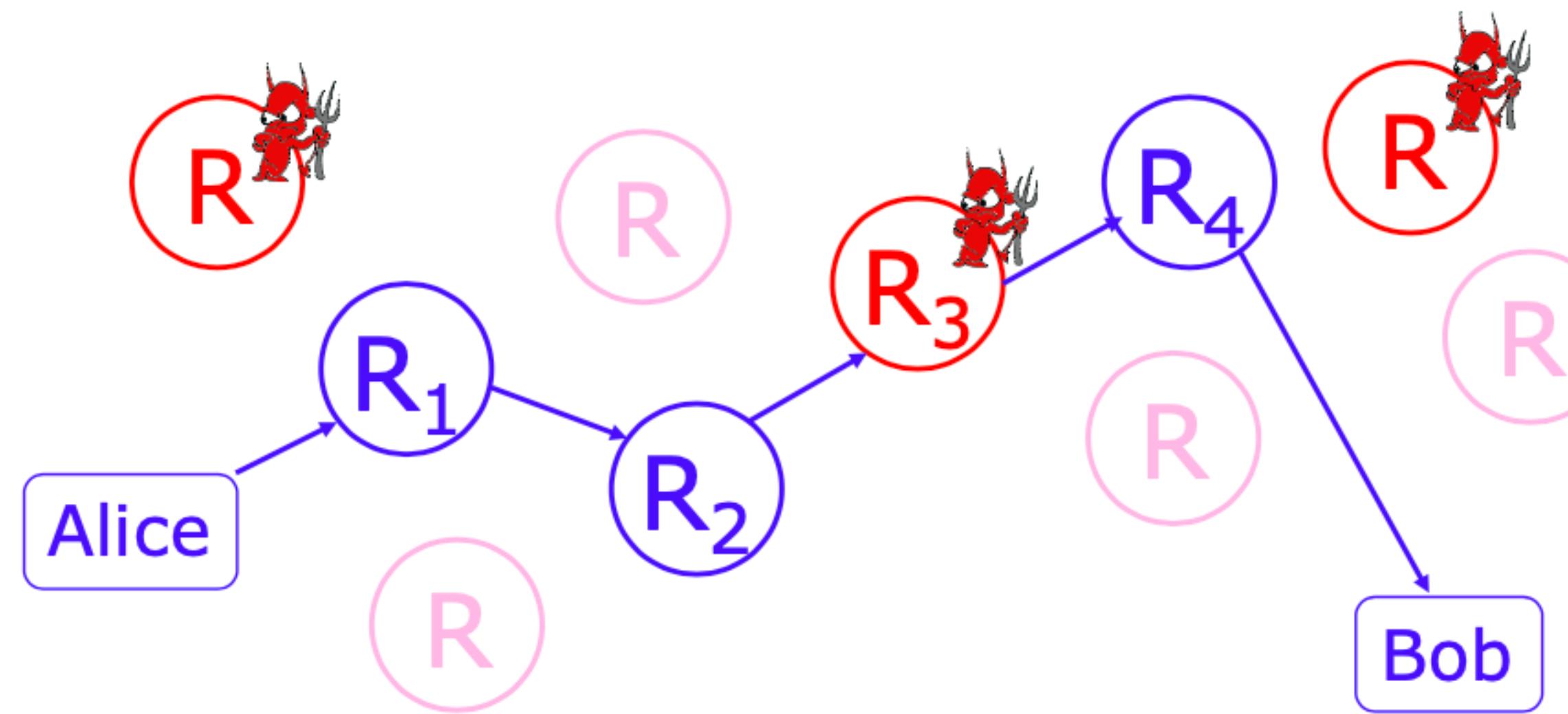
- Each msg is encrypted using public key cryptography
  - The resulting encryption is layered like a Russian doll (except that each doll is of the same size), with the msg as the innermost layer.
  - Each layer of the doll is encrypted with the public key of corresponding node
  - Each layer of the doll is “salted” by adding a random string at each layer, to prevent an adversary from guessing messages.
- Each proxy server strips off its own layer of encryption to reveal where to send the msg next.

# Idea: Randomized Routing



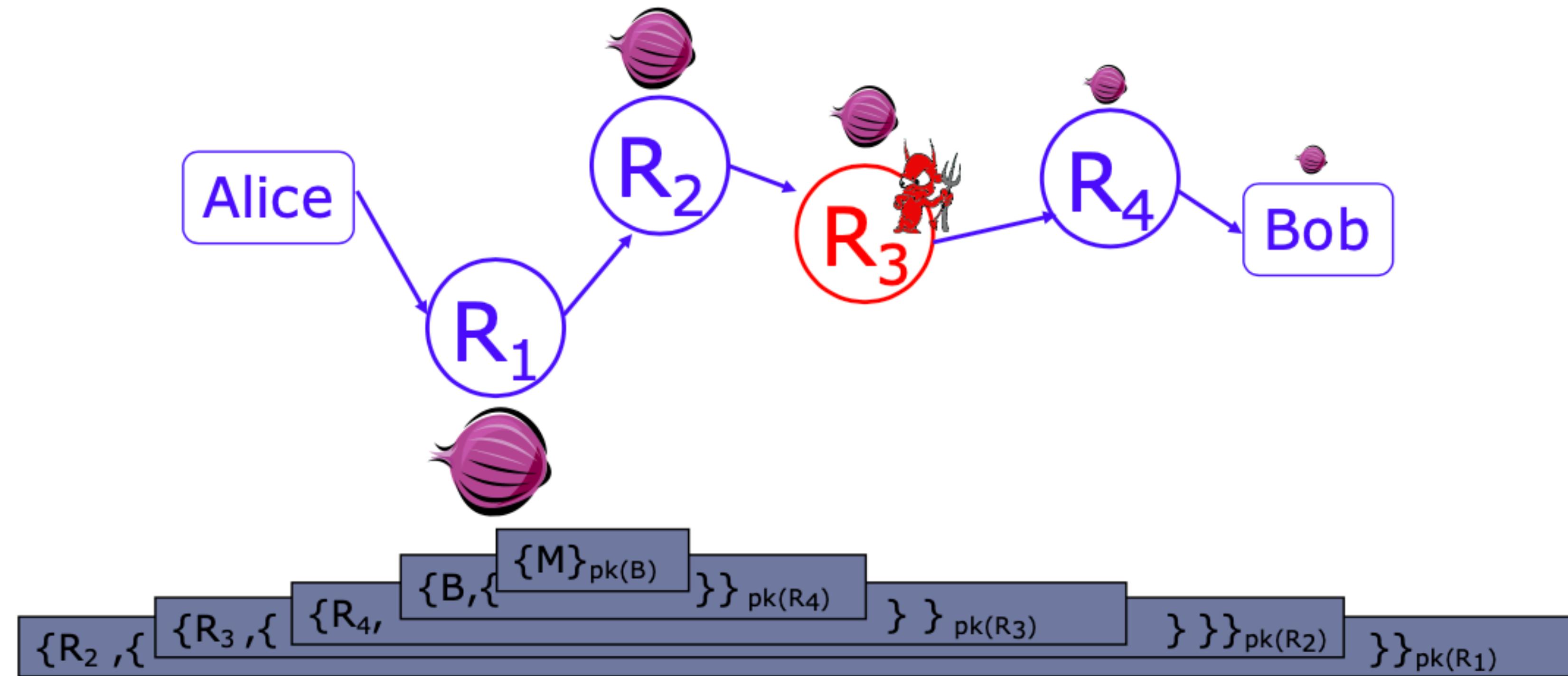
- Hide message source by routing it randomly
  - Popular technique: Crowds, Freenet, Onion routing
  - Routers don't know for sure if the apparent source of a message is the true sender or another router

# Onion Routing



- Sender chooses a random sequence of routers
  - Some routers are honest, some controlled by attacker
  - Sender controls the length of the path.

# Route Establishment



- Routing info for each link encrypted with router's public key.
- Each router learns only the identity of the next router.

# Disadvantages of Basic Mixnets/Onion Routing

- Public-key encryption and decryption at each mix/router are computationally expensive
- Basic mixnets have high latency
  - Ok for email, not Ok for anonymous Web browsing
- Challenge: low-latency anonymity network

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# Browse Privately. Explore Freely.

Defend yourself against tracking and surveillance. Circumvent censorship.

[Download Tor Browser](#)



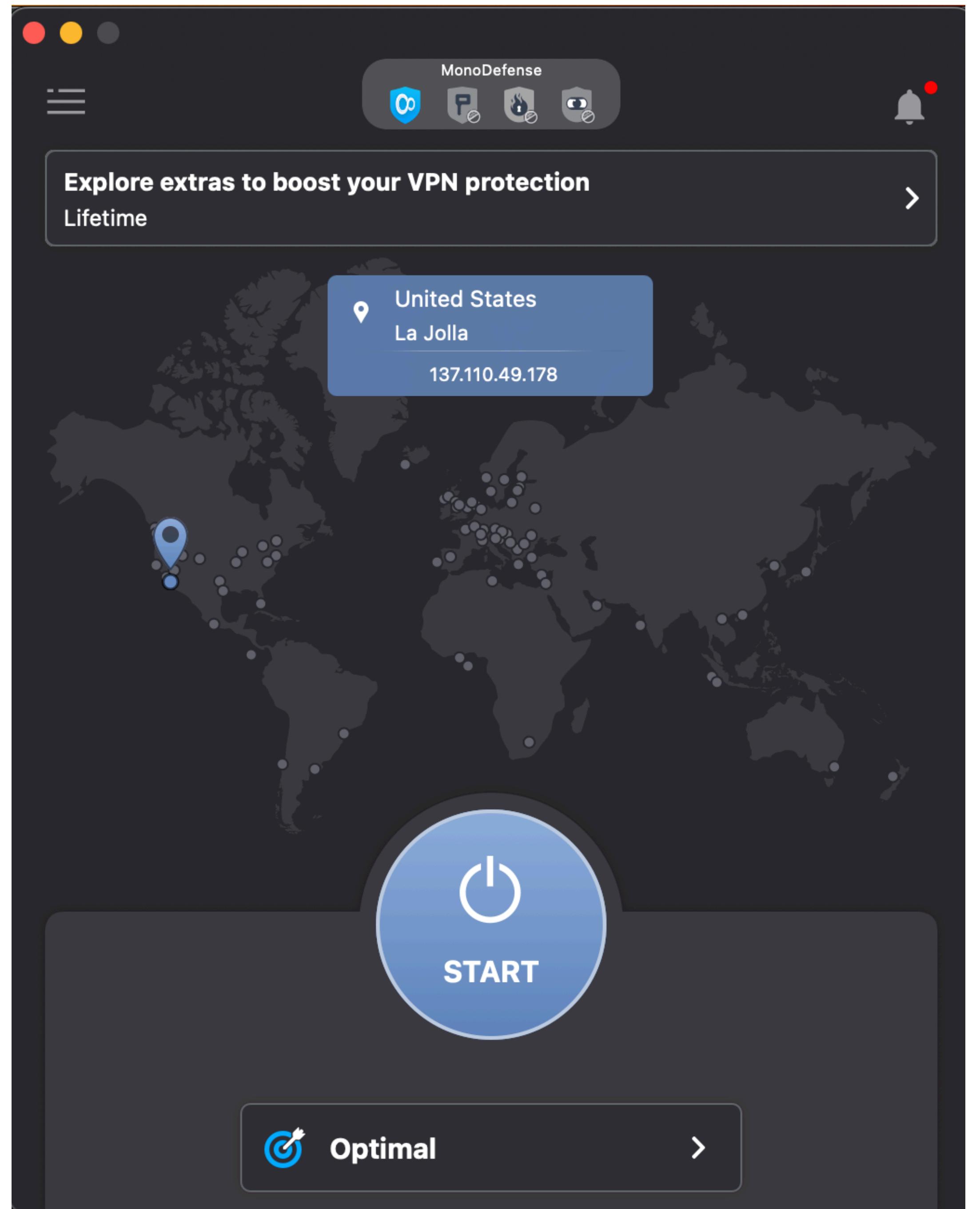
#### BLOCK TRACKERS

Tor Browser isolates each website you visit so third-party trackers and ads can't follow you. Any cookies automatically clear when you're done browsing. So will your browsing history.

#### DEFEND AGAINST SURVEILLANCE

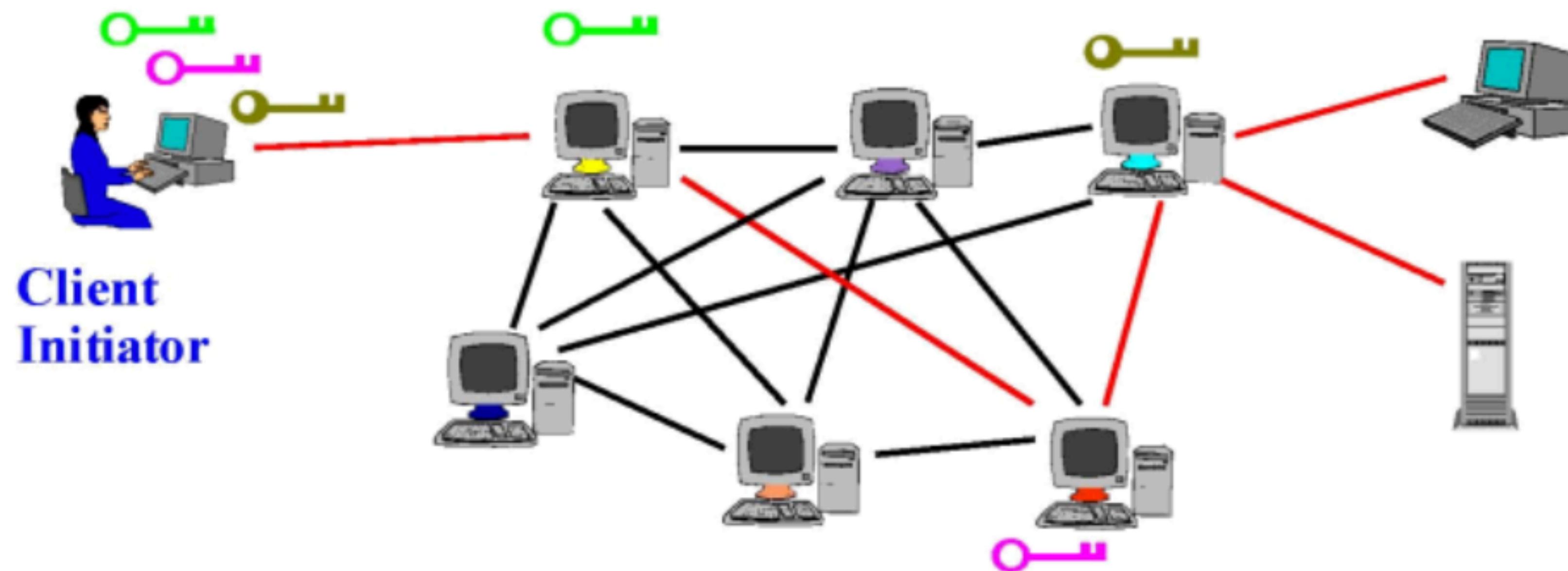
Tor Browser prevents someone watching your connection from knowing what websites you visit. All anyone monitoring your browsing habits can see is that you're using Tor.



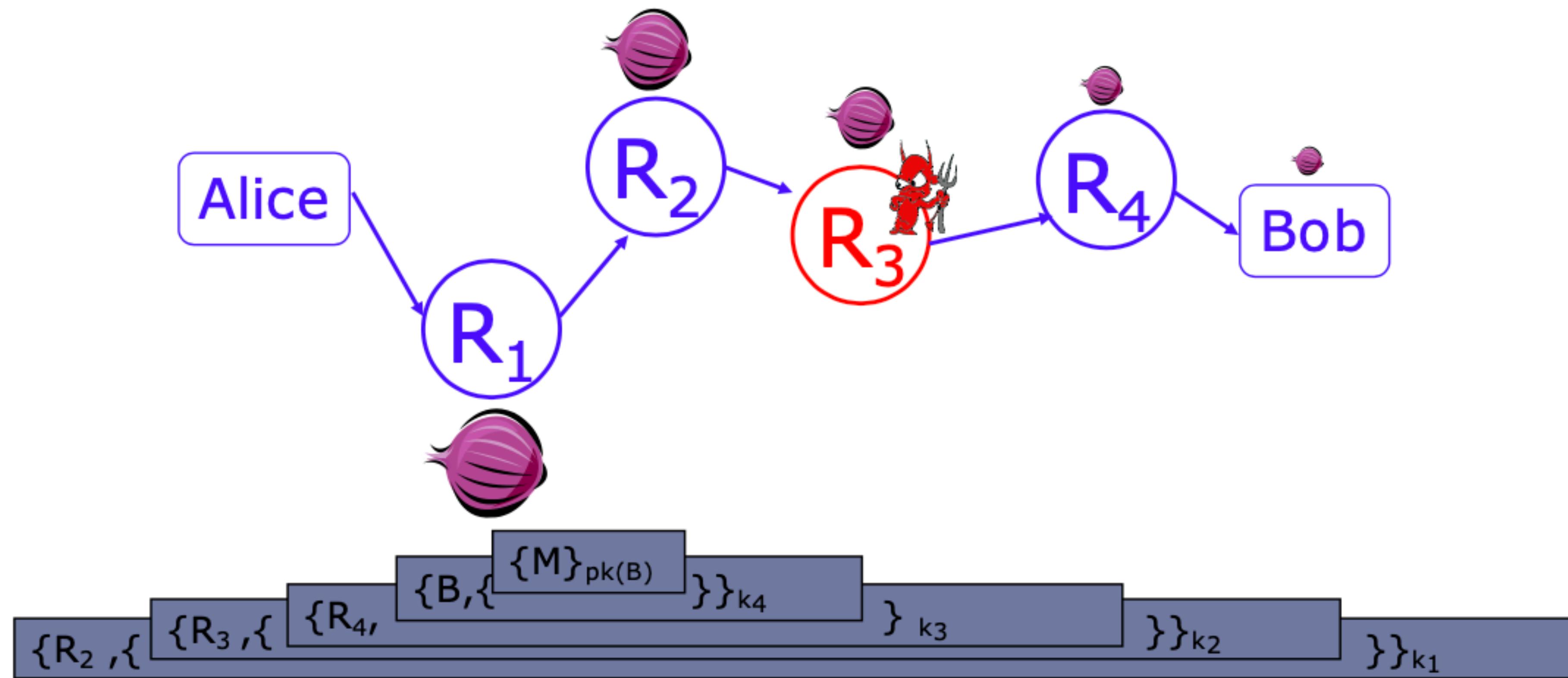


# Using a Tor Circuit

- Client applications connect and communicate over the established Tor circuit
  - Note onion now uses only symmetric keys for routers



# Using a Tor Circuit(details)

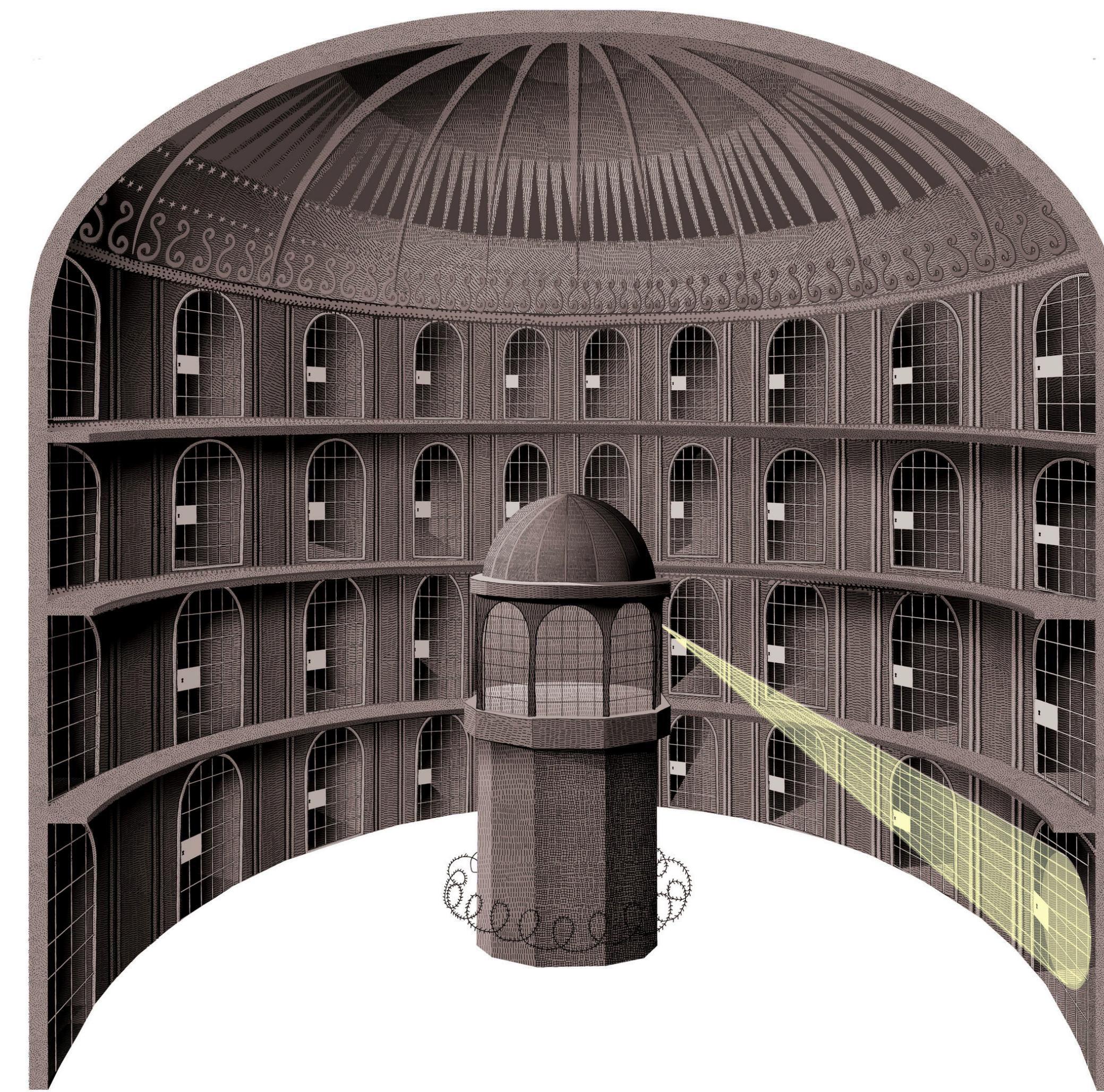


- Note onion now uses only symmetric keys for routers

# Tor management issues

- Many applications can share one circuit
  - Multiple TCP streams over one anonymous connection
- Tor router doesn't need root privileges
  - Encourages people to set up their own routers
  - More participants = better anonymity for everyone
- Directory servers
  - Maintain lists of active onion routers, their locations, current public keys, etc.
  - Control how new routers join the network
    - “Sybil attack”: attacker creates a large number of routers
  - Directory servers' keys ship with Tor code

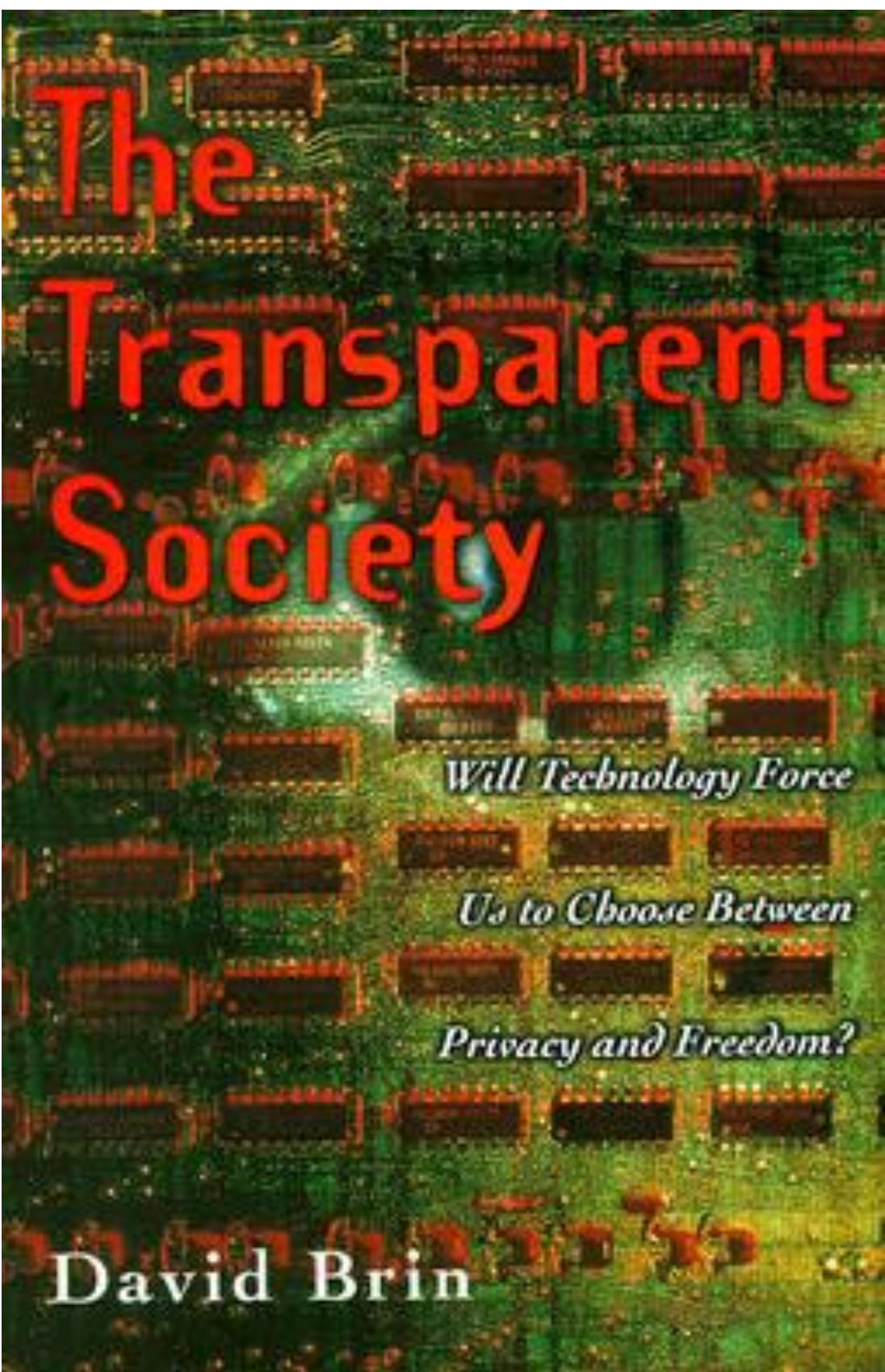
# Surveillance is about power balance



# Approximate Information Flow



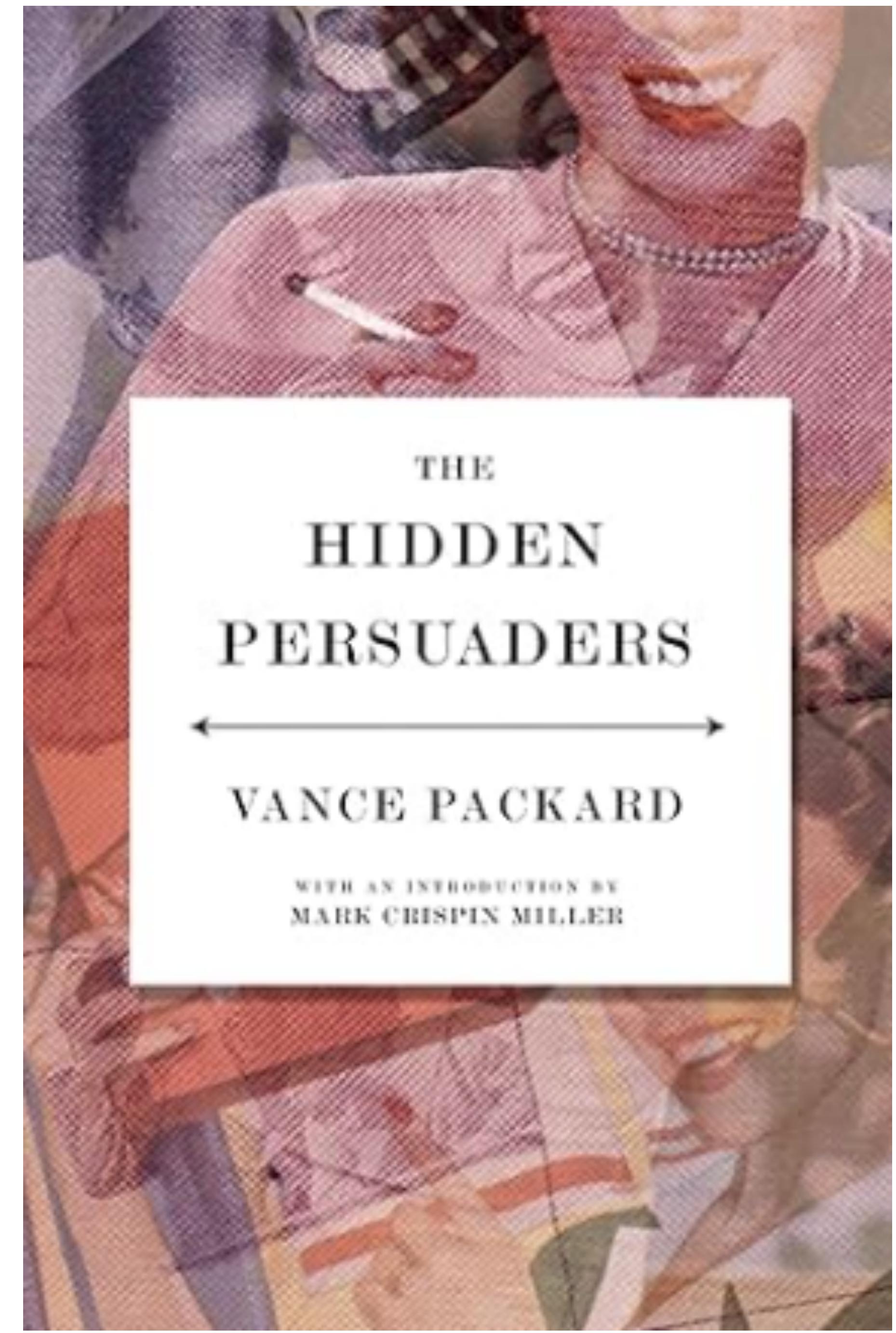
# Sousveillance (inverse surveillance) - Transparency



# Privacy and Agency

- Surveillance and agency
- Manipulation and behavioral influence
- AI-Participated decision making

# The art of advertising

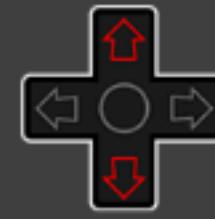


Can we be manipulated through social pressure to commit a murder



# How to Become TripAdvisor's #1 Fake Restaurant?





**Dark  
Pattern  
Games**

 Search for a game

**SIGN IN**

# Helping You Find Healthy Mobile Games



## Avoid addictive gaming dark patterns

A game review website devoted to helping you find games that don't use psychological tricks to manipulate you into becoming an addicted gamer. Learn about the dark patterns that game designers use to waste your precious time and money.



**Definition:** A gaming dark pattern is something that is deliberately added to a game to cause an unwanted negative experience for the player with a positive outcome for the game developer.



bird houses



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# How does Amazon Rank their results?

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shipped by Amazon

Delivery Day  
 Get It by Tomorrow

Customer Reviews  
★★★★★ & Up

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\$0 - \$4,200+

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All Discounts  
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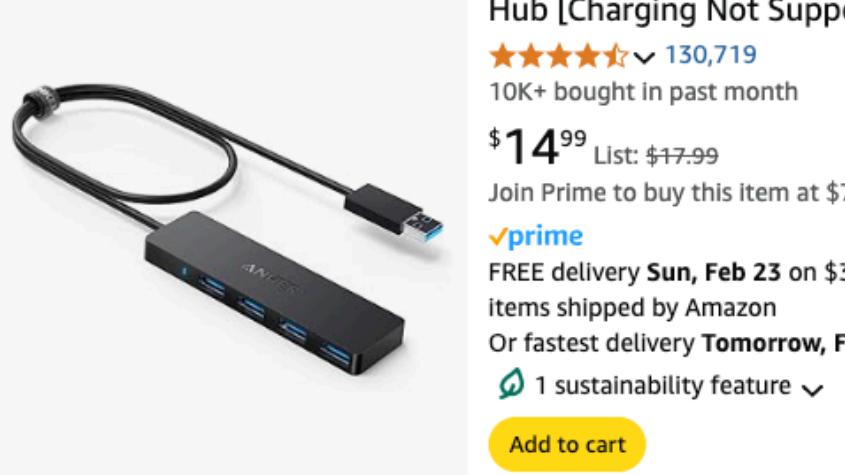
Special Features  
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See options

Overall Pick   
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★★★★★ 130,719  
10K+ bought in past month  
\$14<sup>99</sup> List: \$17.99  
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1 sustainability feature  
Add to cart

# How does Amazon Rank their results?

Hello:

Good day!

Now launch of product "8 in 1 USB C HUB item experience" activity.

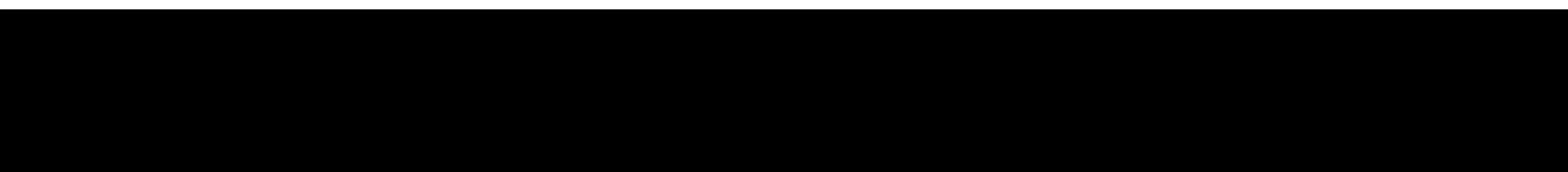
This 8-in-1 USB-C Docking Station: Equipped with a 100W USB-C  
card slots and 2 high-speed USB3.0 ports.

We will cover the item purchasing fee+ PP fee+Tax fee for you(From Paypal or Amazon),  
pls leave a great review which u think wanna sharing about our item?

thank you so much and hope have a nice day

Kindly Regards

Lily



...

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# How does Yelp Rank their results?

Yelp

Barbecue | San Diego, CA 92101

Sort: Recommended

**Best Barbecue near San Diego, CA 92101**

**Featured Takeout Options** Sponsored

**Manna Heaven BBQ** 3.8 (17 reviews) Seafood Barbecue Open until 10:00 PM Get Directions

**Smokin J's BBQ & Taphouse** 4.5 (214 reviews) Breakfast & Brunch Barbecue \$\$ Open until 8:30 PM Get Directions

**Besthibachi** 46 reviews Barbecue Japanese Open until Midnight Get Directions

**Sponsored Results**

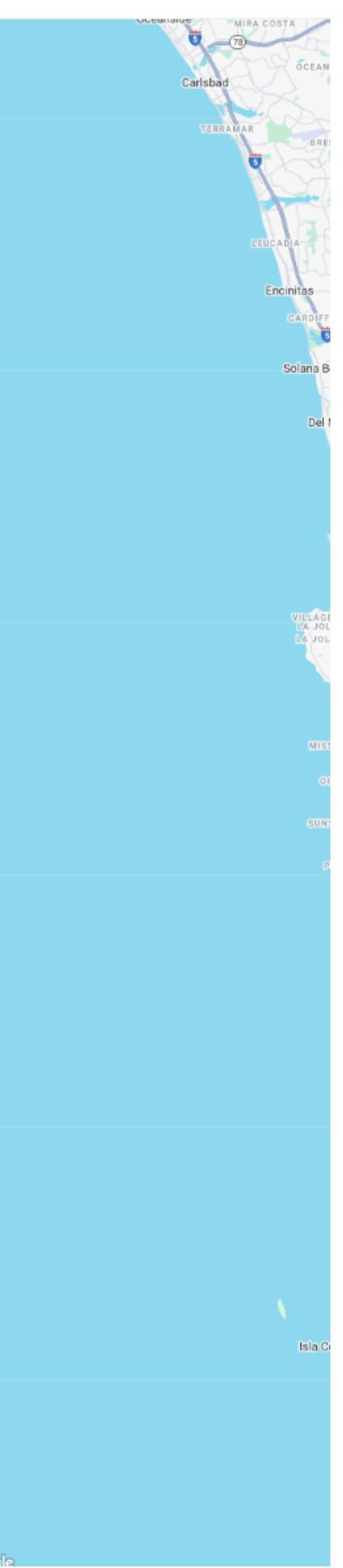
**Manna Heaven BBQ** 3.8 (17 reviews) Gaslamp • Open until 10:00 PM 14 years in business Locally owned & operated We went to the one in Kearny Mesa and figured we would give this one a chance. The food is delicious, quick and great service! Definitely would come... more Order

**Smokin J's BBQ & Taphouse** 4.5 (214 reviews) Gaslamp • \$\$ • Open until 8:30 PM Family-owned & operated Gluten-free friendly Make an Online Reservation Serving slow-smoked BBQ for breakfast, lunch, and dinner, with a long tap list of local beer and cider. Smokin J's BBQ was founded in 2016 by a man... more Reserve

All "barbecue" results near me in San Diego, California - February 2025

**1. Phil's BBQ** 4.3 (16.7K reviews) Midway • \$\$ • Open until 10:00 PM Known far and wide for its mouthwatering barbecued ribs and other delectable delights, Phil's BBQ is... more Reserve

Barbecue Bars American Casual Touristy



Sort: **Most Reviewed** ⓘ

**Recommended**

**Highest Rated**

**Most Reviewed**

# How does CSRankings.org rank the results?

## CSRankings: Computer Science Rankings

CSRankings is a metrics-based ranking of top computer science institutions around the world. Click on a triangle (▶) to expand areas or institutions. Click on a name to go to a faculty member's home page. Click on a chart icon (the bar chart icon after a name or institution) to see the distribution of their publication areas as a bar chart. Click on a Google Scholar icon (GS) to see publications, and click on the DBLP logo (DL) to go to a DBLP entry. Applying to grad school? Read this first. For info on grad stipends, check out CSStipendRankings.org. Do you find CSRankings useful? Sponsor CSRankings on GitHub.

Rank institutions in USA by publications from 2014 to 2024

#	Institution	Count	Faculty
1	Carnegie Mellon University	22.8	197
2	Univ. of Illinois at Urbana-Champaign	16.3	126
3	Univ. of California - San Diego	14.6	126
4	Georgia Institute of Technology	12.3	137
5	Massachusetts Institute of Technology	11.8	107
6	University of Michigan	11.3	106
7	University of Washington	11.2	83
8	Univ. of California - Berkeley	11.1	95
9	Cornell University	10.6	94
10	University of Maryland - College Park	10.0	89
11	Stanford University	9.9	62
12	Northeastern University	8.7	96
13	Purdue University	7.5	67
14	New York University	7.3	93
14	University of Texas at Austin	7.3	45
16	Princeton University	6.9	64
16	University of Pennsylvania	6.9	70
18	Columbia University	6.8	53
19	Univ. of California - Los Angeles	6.7	48
20	University of Wisconsin - Madison	6.5	63
21	University of Southern California	6.1	64
22	University of Massachusetts Amherst	5.9	63
23	University of Chicago	5.8	52

This ranking is designed to identify institutions and faculty actively engaged in research across a number of areas of computer science, based on the number of publications by faculty that have appeared at the most selective conferences in each area of computer science (see the FAQ for more details).

We gratefully acknowledge the generous support of our sponsors, including Stony Brook University. Sponsor CSRankings

## FAQ Computer Science Rankings

Frequently asked questions for CSRankings.org.

### Why another ranking? Why this methodology?

Rankings are intensely popular and influential. While we might wish for a world without rankings, wishing will not make rankings go away.

Given this state of affairs, it makes sense to aim for a ranking system that is meaningful and transparent. Unfortunately, the most influential rankings right now are those from US News and World Report, which is entirely reputation-based and relies on surveys sent to department heads and directors of graduate studies.

By contrast, CSRankings is entirely metrics-based: it weighs departments by their presence at the most prestigious publication venues. This approach is intended to be both incentive-aligned (faculty already aim to publish at top venues) and difficult to game, since publishing in such conferences is difficult. It is admittedly bean-counting, but its intent is to "count the right beans." It is also entirely transparent; all code and data are publicly available at <https://github.com/emeryberger/CSRankings> under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (note: this means you may not distribute anything built from CSRankings' code or data).

### How about incorporating citations?

Unfortunately, citation-based metrics have been repeatedly shown to be subject to manipulation. There are universities instructing faculty to cite each other, and the phenomenon of "citation cartels" is well documented.

There are also methodological challenges: citations for all papers are not freely available and change rapidly, and citation count systems like Google Scholar do not do a great job of disambiguating authors and can be gamed by authors. (See Et al.'s page for a humorous example.)

Note that selective conferences are already a proxy for citation impact: papers published at these conferences are on average much more highly cited than papers that appear in less selective, less prestigious venues.

### What do adjusted counts and average counts mean?

Adjusted counts: each publication is counted exactly once, with credit adjusted by splitting evenly across all co-authors. This approach makes it impossible to boost rankings simply by adding authors to a paper.

Average count is the geometric mean of the adjusted counts per area (for n areas selected, this is the nth root of the product of all adjusted counts (+1)).

$$\text{averageCount} = \sqrt[N]{\prod_{i=1}^N (\text{adjustedCounts}_i + 1)}$$

This computation implicitly normalizes for publication rates and sizes of areas.

Note that publications must be at least 6 pages long to be counted.

### How were research areas determined?

Nearly all categories are based on research-focused ACM SIGs. Areas not represented by ACM SIGs are intended to span most established research-centric areas of computer science.

### Why is (some area) not included?

For any research-focused area to be included, at least 50 R1 institutions must have publications in the top conferences in that area in the last 10 years. This threshold is to ensure that there is enough research activity in an area to enable a meaningful ranking. A number of ACM SIGs do not meet this criteria.

### How were the conferences selected?

The conferences listed were developed in consultation with faculty across a range of institutions, including via community surveys.

### Why so few conferences per area?

Only the very top conferences in each area are listed. All conferences listed must be roughly equivalent in terms of number of submissions, selectivity and impact to avoid creating incentives to target less selective conferences.

### Why is conference X not listed?

Additional conferences are not listed when they are not roughly equivalent to the rest. This selection is generally uncontroversial but in some communities

# What are the factors? [TBD]

- Factors:
  - ~~How important the privacy is?~~
  - ~~How strong my will is?~~
  - ~~What will happen if I lose my privacy?~~
  - ~~The likelihood of being watched?~~

# Privacy and Agency

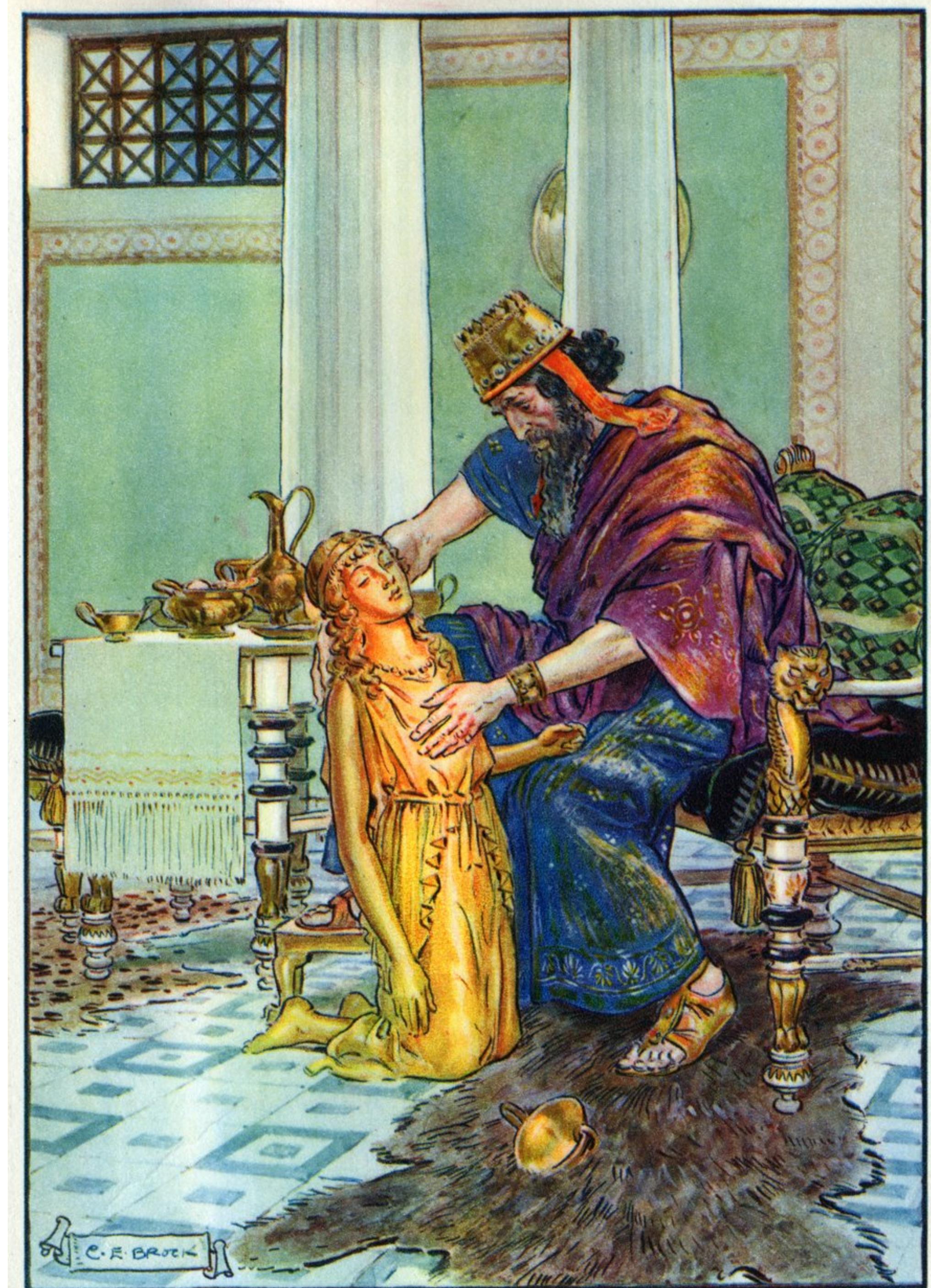
- Surveillance and agency
- Manipulation and behavioral influence
- AI-Participated decision making

# AI-participated | Mediated Decision Making

- Human delegates the task to AI assistants without clear descriptions.

# What can go wrong?

- requirements are wrong.



# What can go wrong?

- System been hacked by unauthorized users.



# What can go wrong?

- Systems are incapable of executing the designated tasks.



# What can go wrong?

# Black Mirror White Christmas Cookie part 2



# Simulation Hypothesis

- "The fraction of human-level civilizations that reach a posthuman stage (that is, one capable of running high-fidelity ancestor simulations) is very close to zero", or
- "The fraction of posthuman civilizations that are interested in running simulations of their evolutionary history, or variations thereof, is very close to zero", or
- "The fraction of all people with our kind of experiences that are living in a simulation is very close to one".

# What are the factors? [TBD]

- Factors:
  - ~~How important the privacy is?~~
  - ~~How strong my will is?~~
  - ~~What will happen if I lose my privacy?~~
  - ~~The likelihood of being watched?~~