Dear Facebook, My Data is None of Your Business

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WOSN 2008

Privacy in Cloud Computing

- Search history (Google, Yahoo, AOL)
- Emails (Yahoo, Microsoft, Google)
- Documents, Medical history! (Google)
- Photos (Flickr, Google)
- Video watching history (YouTube, Google)
- Web browsing history (DoubleClick, Google)
- Social networks (Facebook, MySpace, Google)

Privacy in Social Networks

Facebook Privacy Policy (Aug 6, 2008)

- All such sharing of information is done **at your own risk.** Please keep in mind that if you disclose personal information in your profile or when posting comments, messages, photos, videos, Marketplace listings or other items, this **information may become publicly available.**
- You understand and acknowledge that, **even after removal, copies of User Content may remain viewable** in cached and archived pages . . . Removed information may **persist in backup copies** for a reasonable period of time but will not be generally available to members of Facebook. .

Privacy in Social Networks

Larry Page on privacy (BBC Interview, May 19, 2008)

"Social networking is the big problem, [. . . when it comes to search data] there's been very little evidence of damage."

Facebook gaffes

- News Feeds (Sep 2006)
- Beacon (Nov 2007)
- Security hole exposes Paris Hilton's pics (Mar 24, 2008)

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Privacy and Trust in OSN

- If you trust your OSN provider
  - *Who else* can see your data and at what granularity?
  - How easy for lay users to (mis-)configure?
- If you don't trust your OSN provider
  - Stuck with a minimalist profile

Our Problem

How do you have a rich OSN experience when you don't trust the OSN provider to uphold user privacy?

NOYB: Goals

- User controls who has access to his data
- Arbitrary untrusted OSN provider
  - Cannot see private user data
  - Actively adversarial
  - with reasonable (human) resource limitations
- Instantly usable
  - By individuals or small groups of users
  - Preserves as much OSN functionality as possible

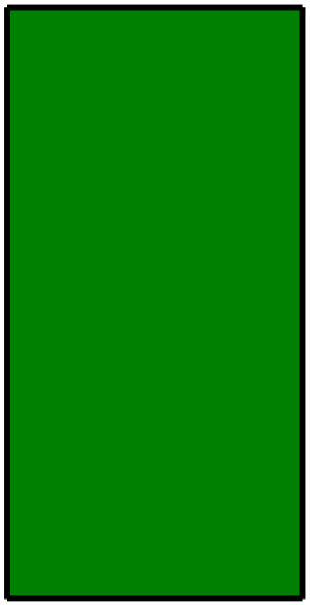
NOYB: Scorecard

- Privacy defined as contextual integrity
- Existence proof: working system
  - Private OSN with rich profiles
  - Arbitrary/adversarial provider
  - Instantly usable by people
- Preserves much OSN functionality
  - Adding new friends
  - Sharing profile and updates with friends
  - ~~Searching for people with similar interests~~
- Experience has reshaped our thinking about how to approach privacy in cloud computing

Privacy as Contextual Integrity

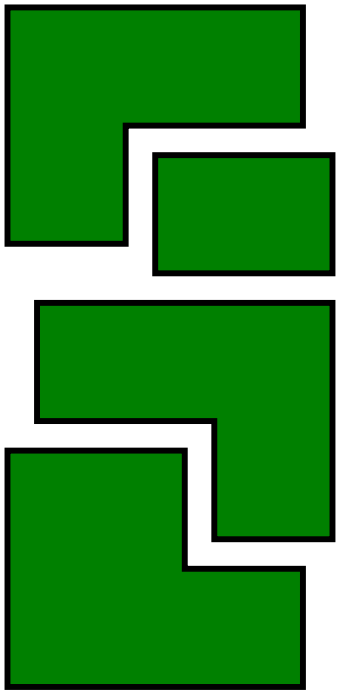
- Profile composed of multiple fields
  - Name, sex
  - Age
  - Relationship status
  - Sexual preference
  - ...
- Out of context, individual fields don't mean much
  - (publicly disclosed in NOYB)
- Ability to recombine fields controls privacy
  - (recombination restricted in NOYB)

NOYB: Profile Scrambling



Alice

NOYB: Profile Scrambling



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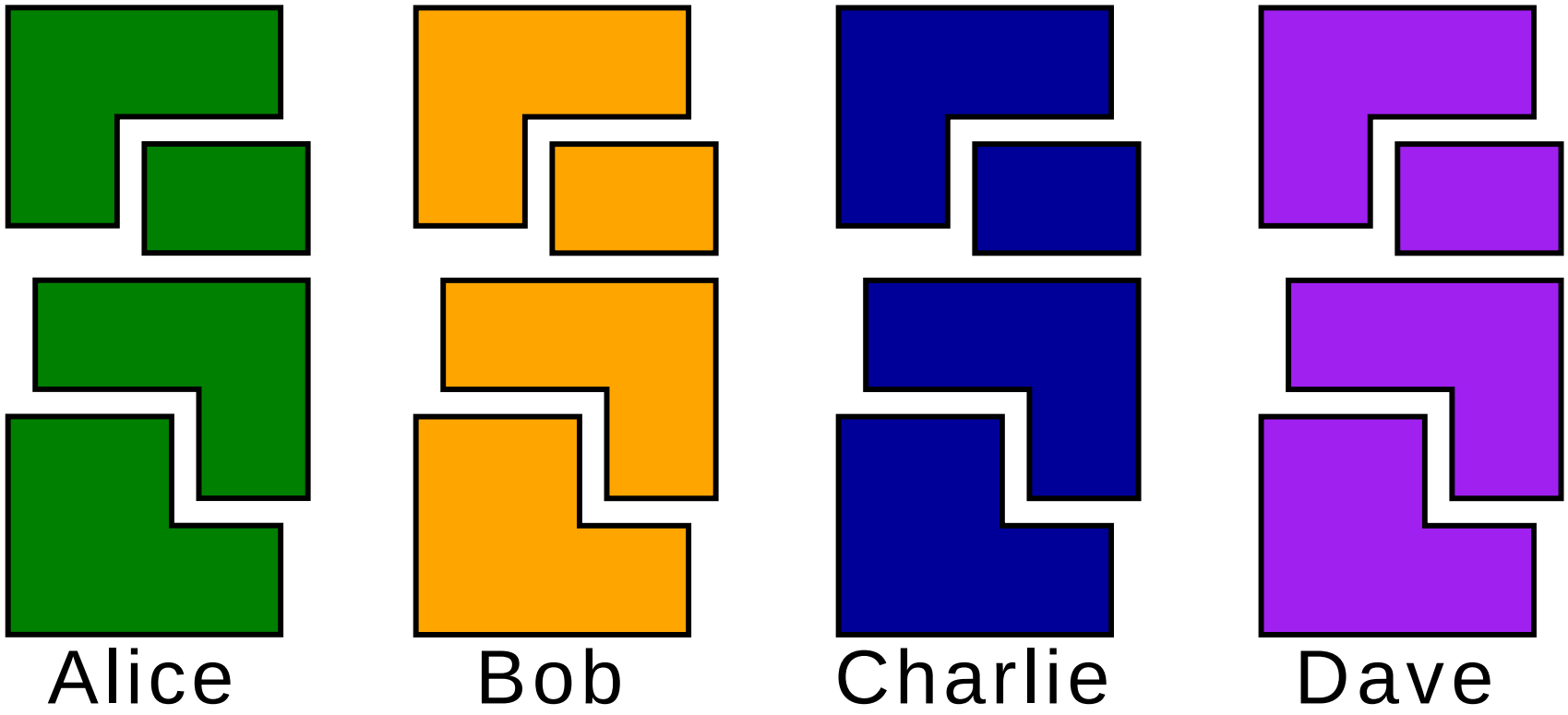

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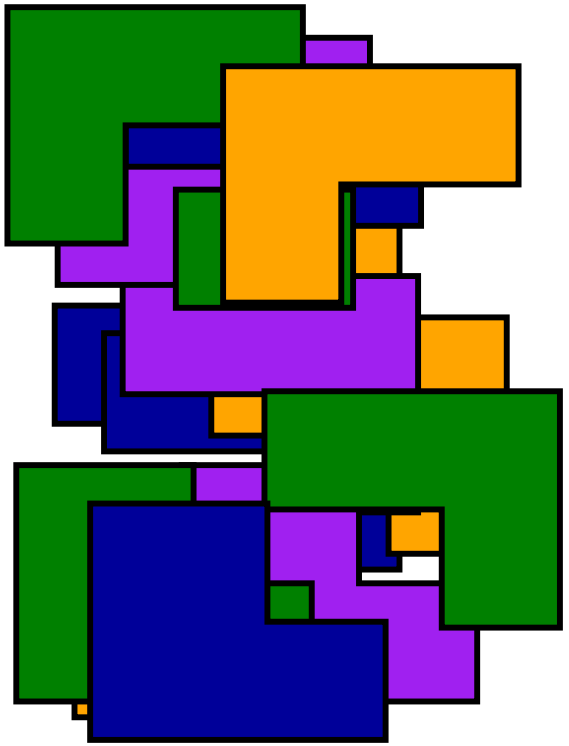

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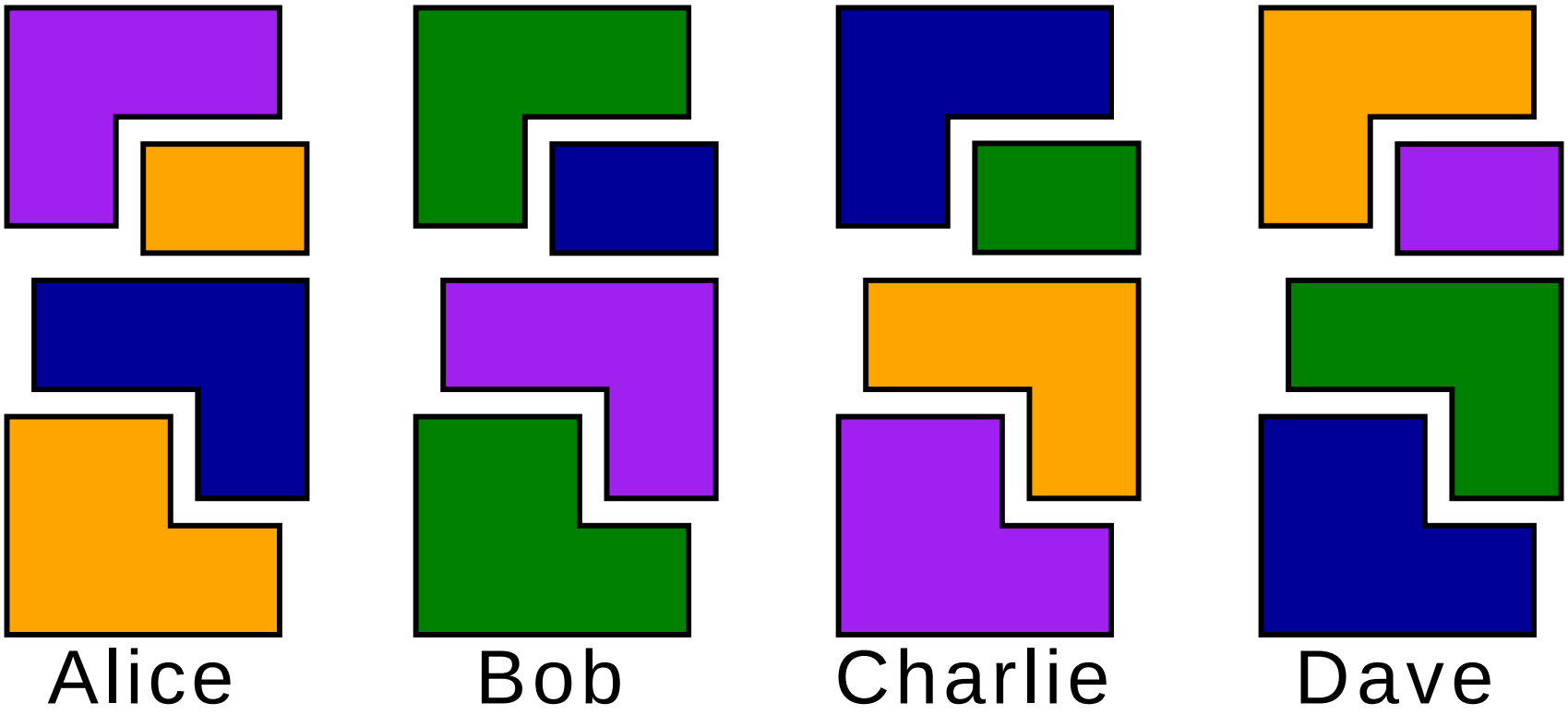
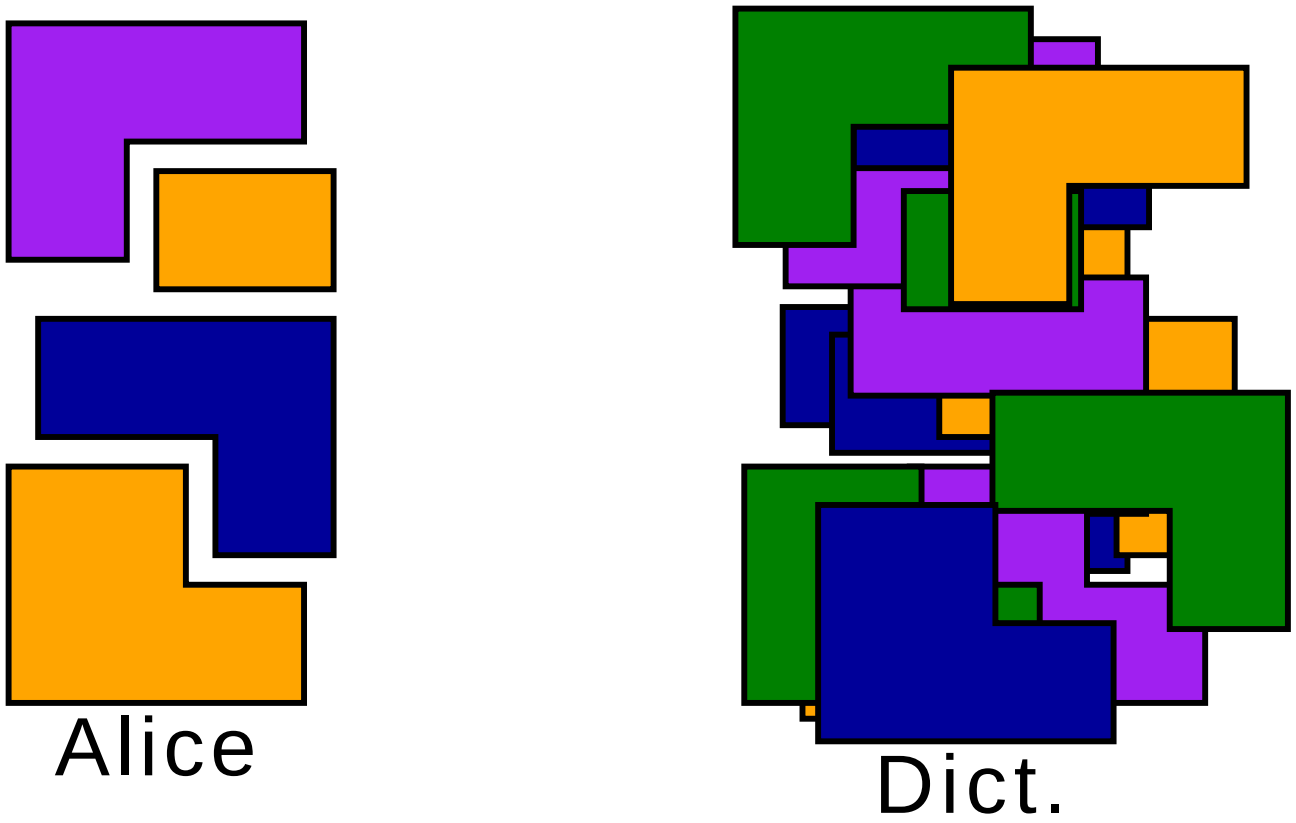


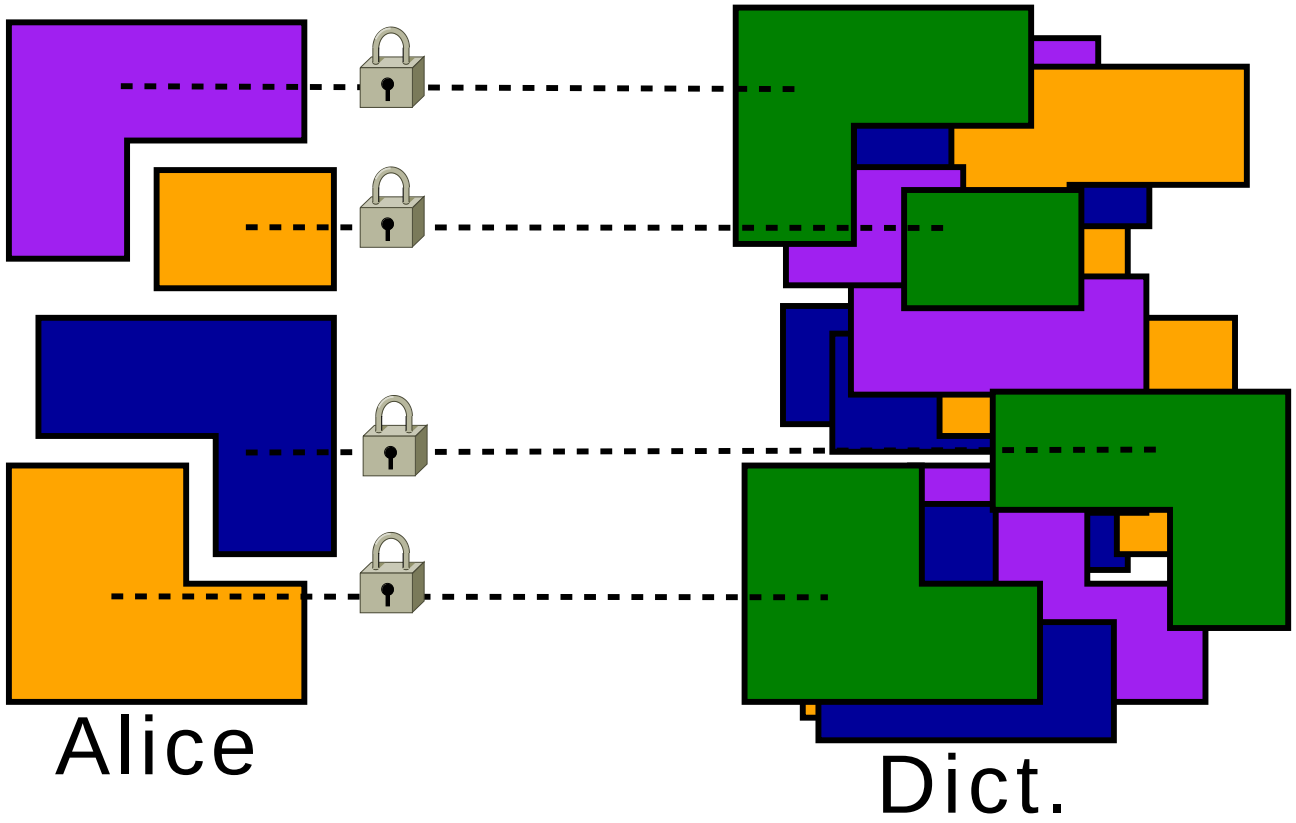
NOYB: Flying Under the Radar

- Scrambled profiles undermine business model (targeted advertising)
  - Facebook may not bother (if few users)
  - But if Facebook does ...
- Hard to *automatically* find NOYB users
  - Piecewise semantically consistent profiles
  - Requires human review (slow)
- PR implications of false accusations
  - NOYB instills reasonable doubt

NOYB: Profile Descrambling



NOYB: Profile Descrambling



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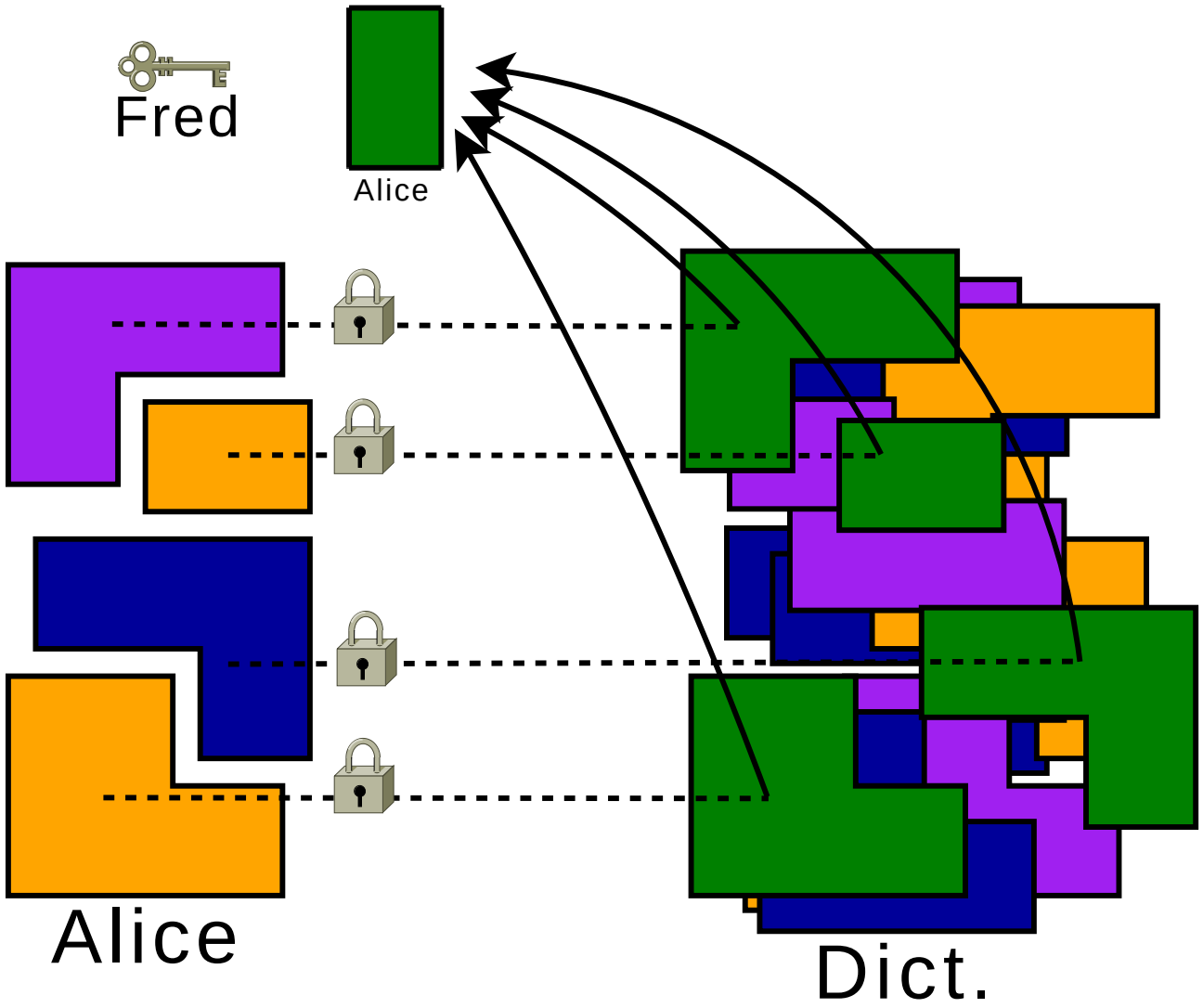
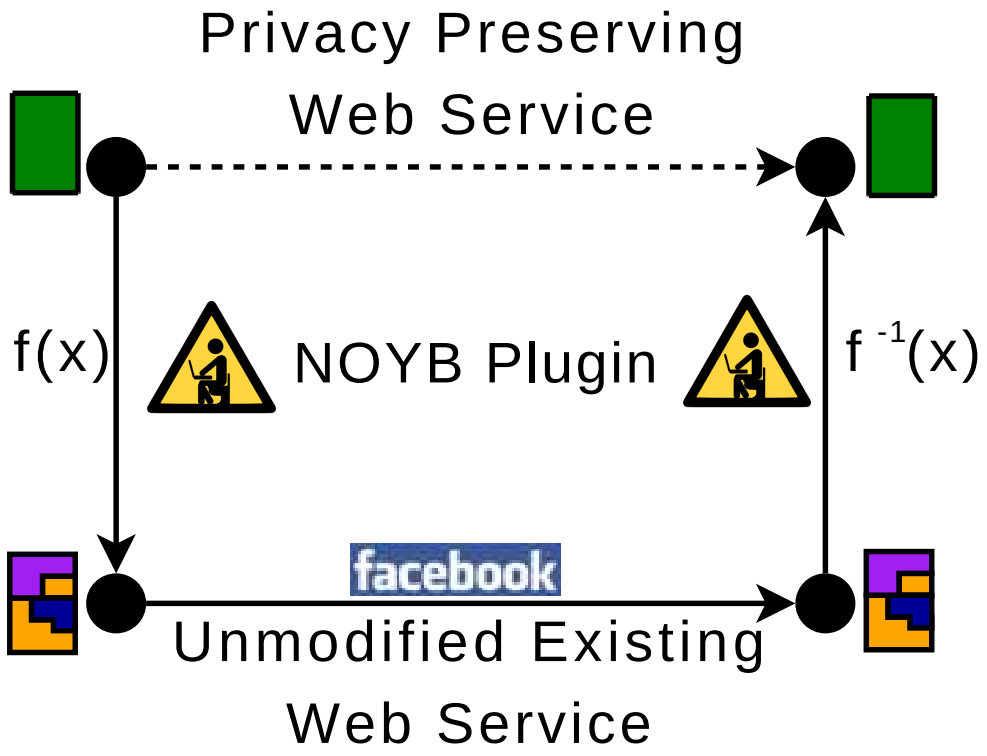


NOYB Properties

- Intended for individuals or small groups
  - No buy-in from Facebook
  - Implemented as a browser plugin
- UI: Scramble, Descramble
  - Hides all crypto
  - Can hide key management

NOYB Lessons Learned



- Privacy preserving abstraction function
  - No changes to underlying service
- Complicates system design
- Hard to maintain (as web service changes)

Conclusions

- Privacy preserving abstraction around existing unmodified web services possible
- NOYB provides privacy defined as contextual integrity
  - For individuals and small groups
- Not a long-term strategy
- Ongoing work on architectures that preserve privacy with cooperation from web service (but without trusting them)
  - Provide incentives for this cooperation

Discussion: Privacy in Web Services

How to Ensure User Privacy?

- Trust providers, but checks and balances through
  - Laws and regulation?
  - Market forces?
- Enforce privacy through technological means
  - with or without provider cooperation?
- Role of endhosts in web services?