

Privacy



EECS 388: Introduction to Computer Security
Mar 23, 2015

Why Privacy?

- Necessary to ensure civil liberties:
 - Free speech, free association, autonomy, freedom from censorship and constant surveillance
- Privacy-motivating examples in U.S. History
 - Martin Luther King Jr. “blackmailed” by FBI
 - McCarthyism witch-hunt for communists
 - Federalist Papers

Typewriters & Privacy



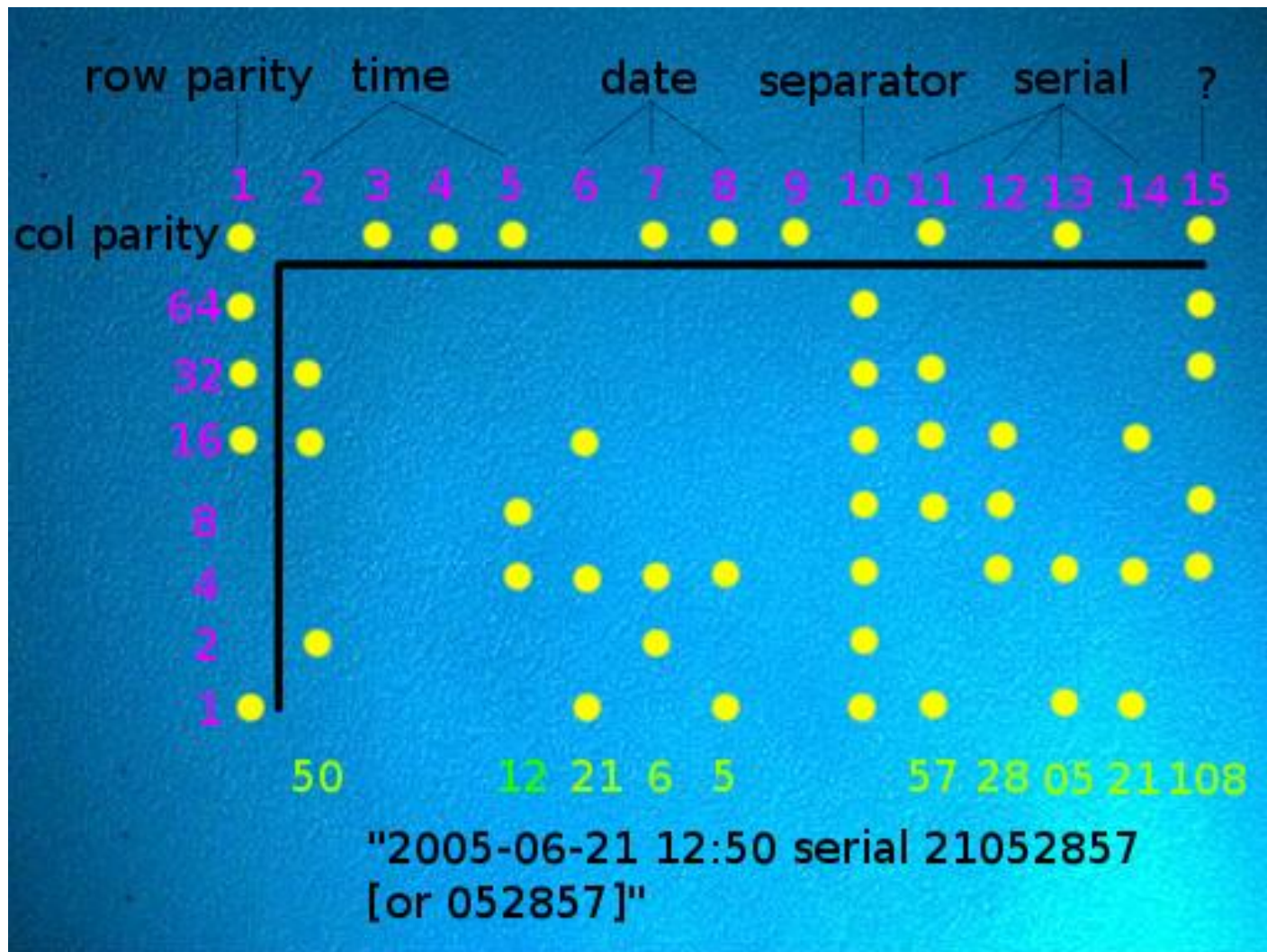
Modern day



Printer Paper



What your printer reveals about you



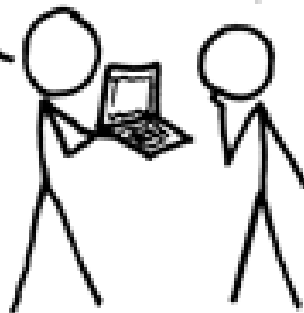
Encrypt your filesystem(s)

A CRYPTO NERD'S IMAGINATION:

HIS LAPTOP'S ENCRYPTED.
LET'S BUILD A MILLION-DOLLAR
CLUSTER TO CRACK IT.

BLAST! OUR
EVIL PLAN
IS FOILED!

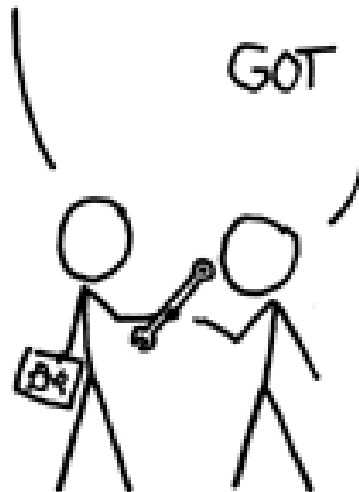
NO GOOD! IT'S
4096-BIT RSA!



WHAT WOULD ACTUALLY HAPPEN:

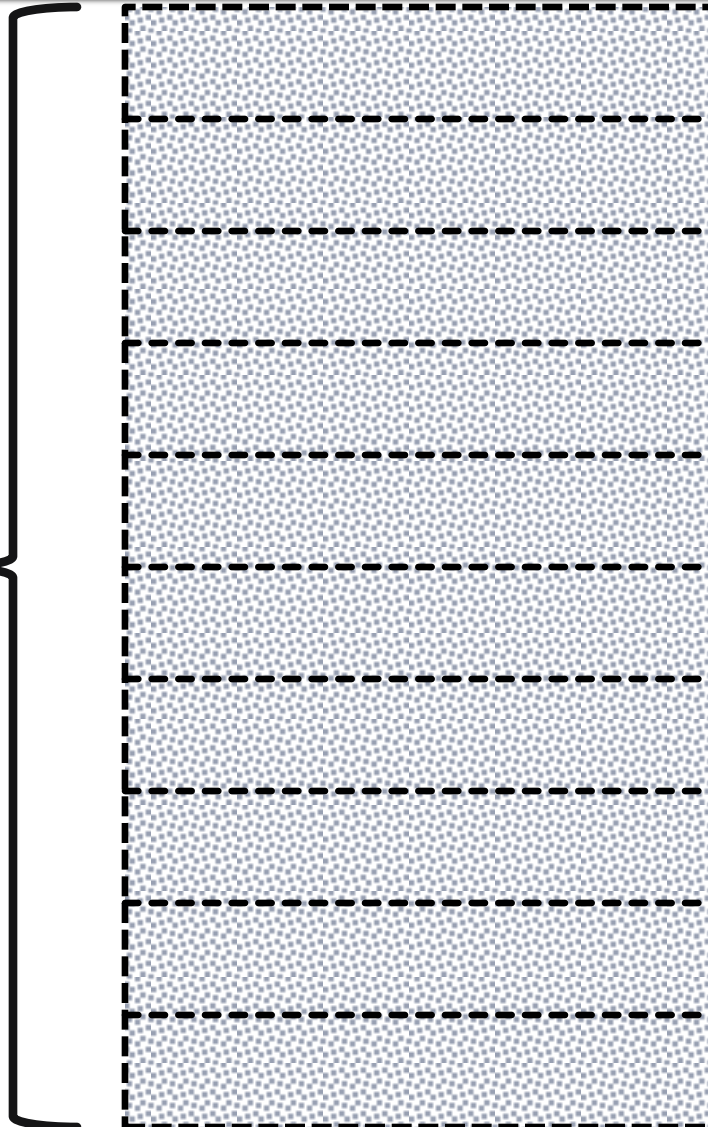
HIS LAPTOP'S ENCRYPTED.
JAIL HIM AND HIT HIM WITH
THIS SUBPEONA UNTIL
HE TELLS US THE PASSWORD.

GOT IT.

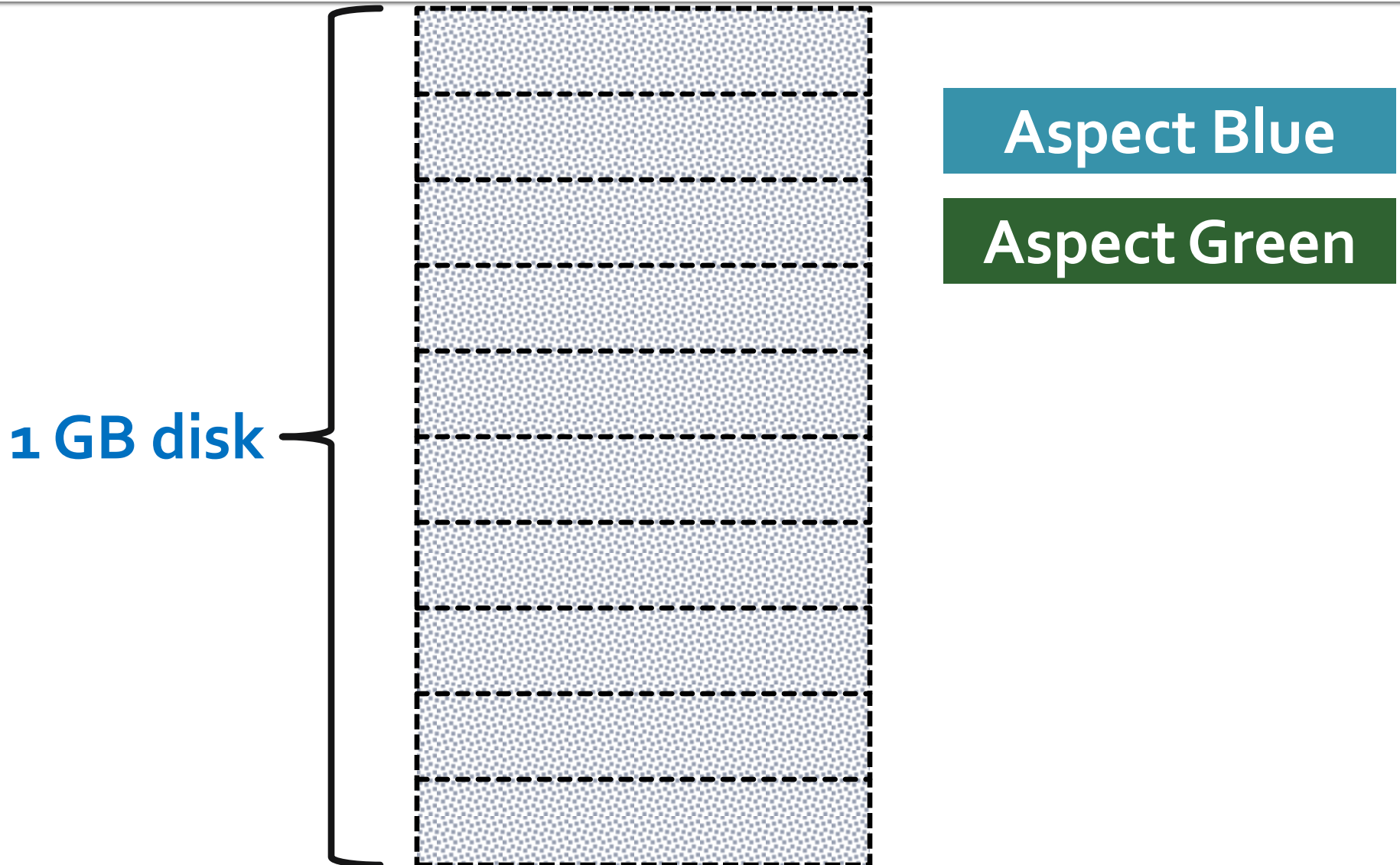


Rubberhose File System

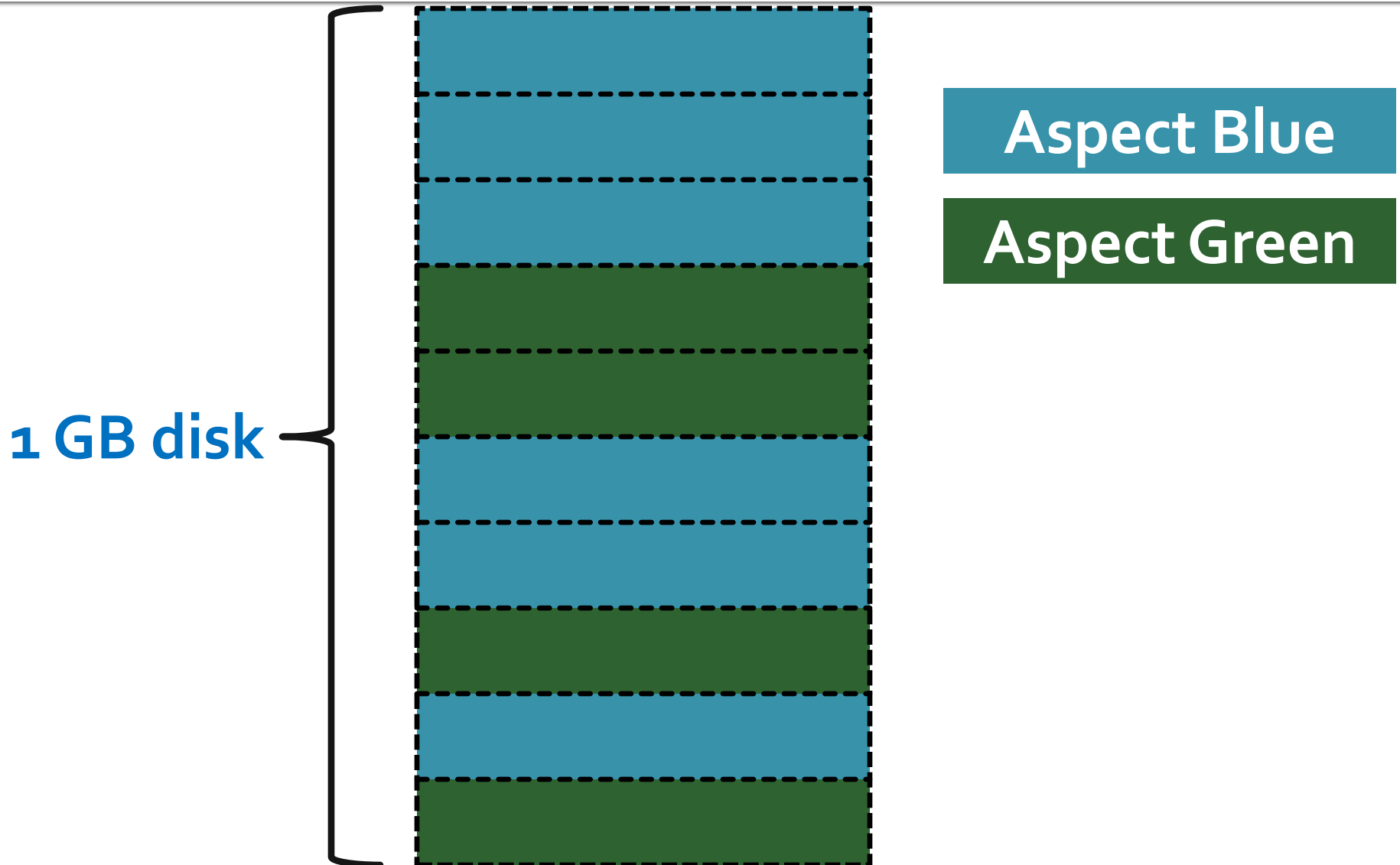
1 GB disk



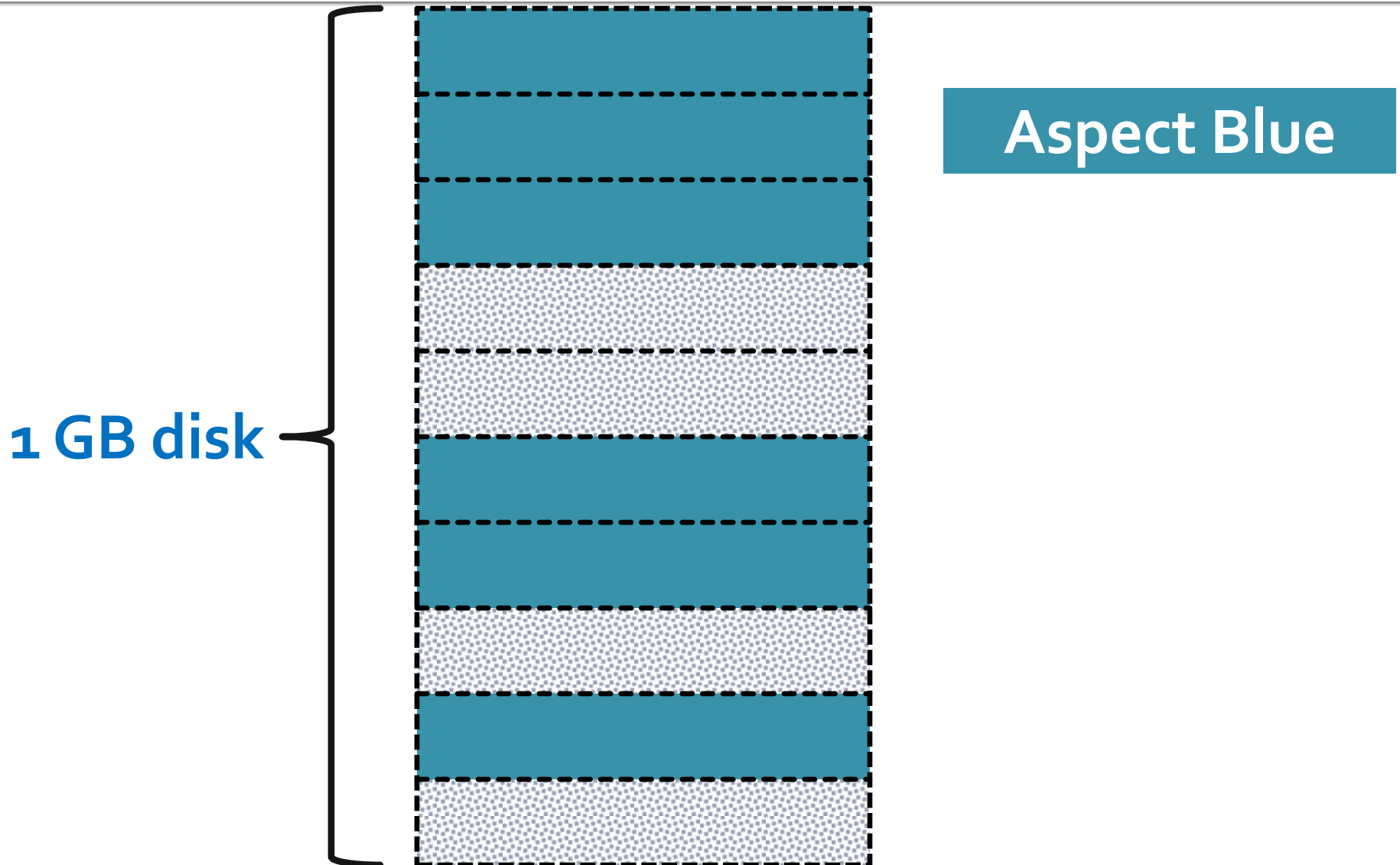
Rubberhose File System



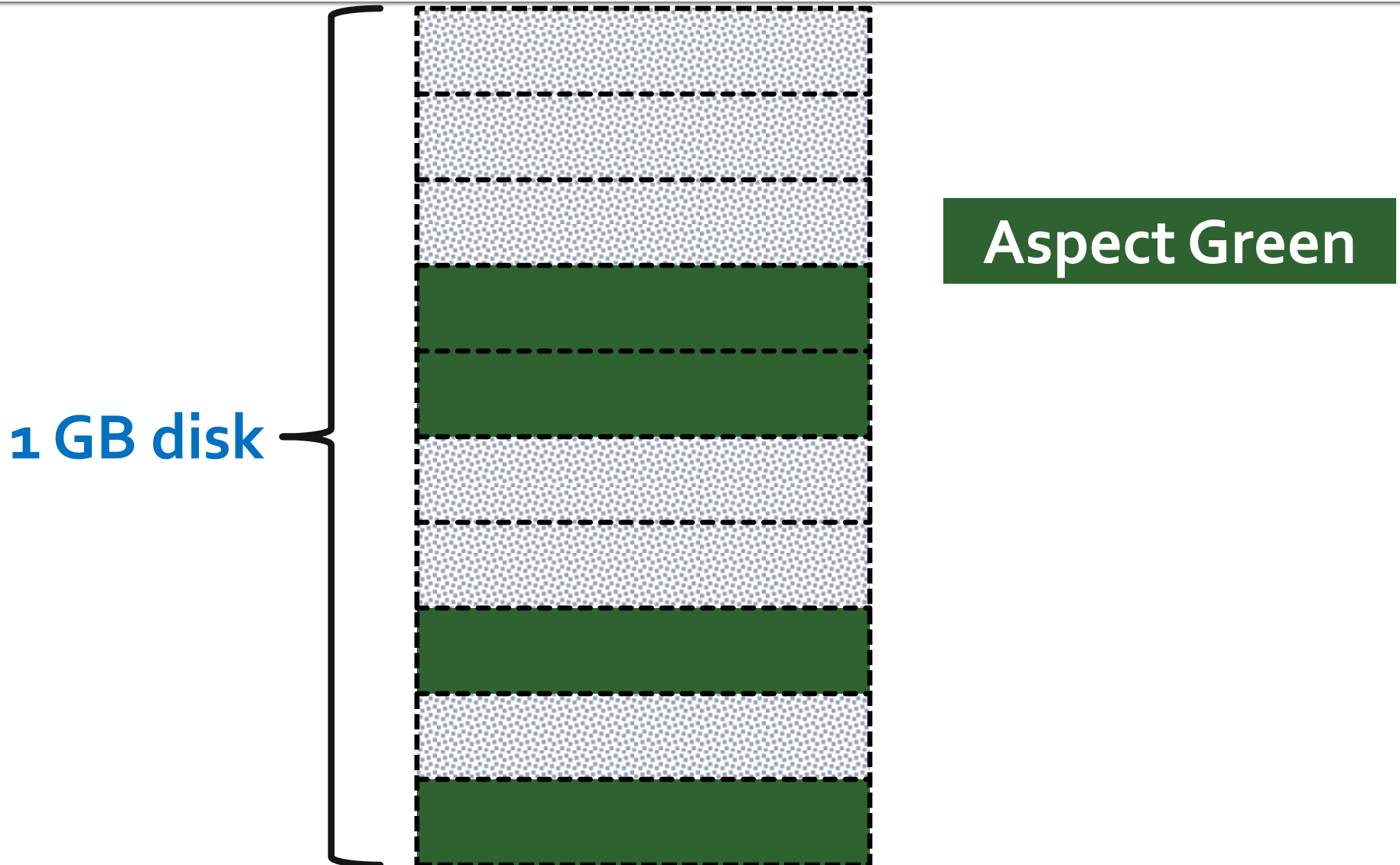
Rubberhose File System



Rubberhose File System



Rubberhose File System



“Direct” sharing

BUSINESS
INSIDER

The Incredible Story Of How Target Exposed A Teen Girl's Pregnancy



GUS LUBIN
FEB. 16, 2012, 10:27 AM

Target broke through to a new level of customer tracking with the help of statistical genius Andrew Pole, according to a [New York Times Magazine](#) cover story by Charles Duhigg.




Pole identified 25 products that when purchased together indicate a woman is likely pregnant. The value of this information was that Target could send coupons to the pregnant woman at an expensive and habit-forming period of her life.

Plugged into Target's customer tracking technology, Pole's formula was a beast. Once it even exposed a teen girl's pregnancy:




[A] man walked into a Target outside Minneapolis and demanded to see the manager. He

“Direct” sharing























 my past flights  

[Web](#) [Shopping](#) [Images](#) [News](#) [Videos](#) [More ▾](#) [Search tools](#)

About 411,000,000 results (0.85 seconds)



Past flights
Only you can see these results

MAR 20	Denver to Detroit 6:45 PM · Frontier		
MAR 18	Detroit to Denver 8:42 AM · Delta		
MAR 4	Los Angeles to Detroit 11:45 AM · Delta		
MAR 4	Los Angeles to Detroit 9:00 AM · American		
MAR 2	Detroit to Los Angeles 1:45 PM · Delta		
FEB 28	Los Angeles to San Diego 7:45 AM · US Airways		
FEB 27	Dallas to Los Angeles 9:35 PM · US Airways		
FEB 27	Denver to San Diego 7:15 PM · Delta		
FEB 27 – 28	Denver to Detroit 6:17 PM · American		
FEB 27	Denver to Detroit 11:45 AM · Delta		
FEB 27	Washington to San Diego 1:07 PM · American		

Direct sharing - Waze



Third-party tracking

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18 Things You Should Know Before Dating a Cat Lady

She knows the difference between a guy who's allergic to cats and a guy who's "allergic to cats."



By Anna Breslaw

12.3k
Shares

f SHARE 12.2K

🐦 TWEET 46

📌 PIN 6

MOST READ



Does Seafood Make Guys Horny?



13 Things You Should Know Before Dating Someone Wh...



Instagram



f 🐦 📌

1. First of all, define "cat lady." Does one cat = cat lady? Two cats = cat lady? Does joking about being a cat lady à la sparkling, outgoing multimillionaire Taylor Swift automatically make one a cat lady? It is my personal belief that most female cat owners below the age of 40 fall into the "not a cat girl, not yet a cat lady" category.

2. Cat ladies mostly look like ... normal ladies. You know. Like regular women. Not like the old hag who sits in front of your local Shop Rite with aluminum foil on her head


Third-party tracking

≡ COSMOPOLITAN

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Shares


f SHARE 12.2K

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MOST READ


THE BEDROOM BLOG



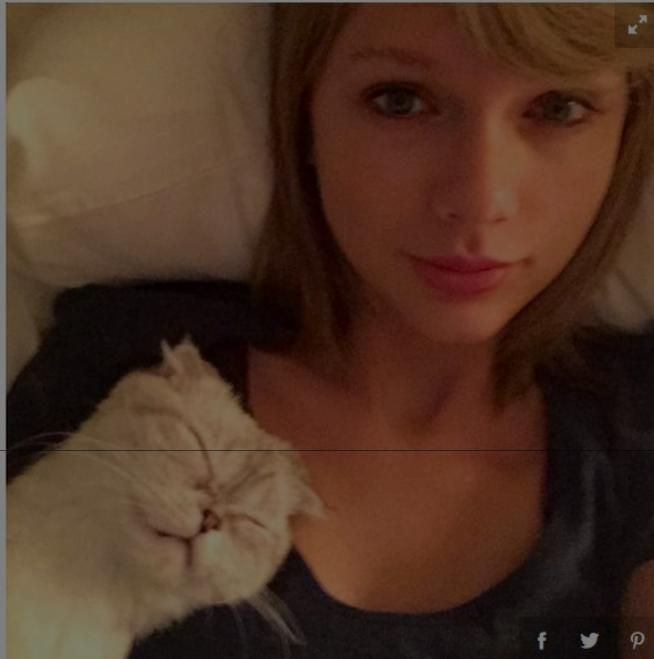
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Instagram

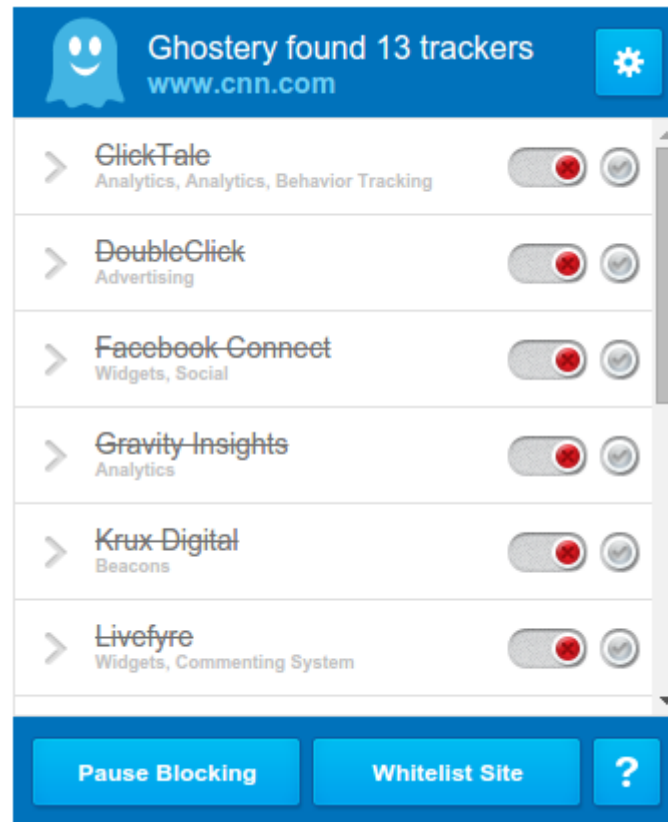


f 🐦 📌

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Blocking with Ghostery



Do Not Track (DNT)

Mozilla Firefox Web Browser — Do Not Track — Mozilla - Mozilla Firefox

Mozilla Firefox (US) | <https://www.mozilla.org/en-US/firefox/dnt/>

FIREFOX ADD-ONS SUPPORT mozilla

HOME > DO NOT TRACK FAQ

Do Not Track

Mozilla is a global, nonprofit organization dedicated to making the Web better. We emphasize principle over profit, and believe that the Web is a shared public resource to be cared for, not a commodity to be sold. We answer to no one but you and believe it is crucial to put you in control of your online experience. We are aiming to give you better insight and control into the ways your personal information is collected, used, stored and shared online.

Mozilla Firefox offers a Do Not Track feature that lets you express a preference not to be tracked by websites. When the feature is enabled, Firefox will tell advertising networks and other websites and applications that you want to opt-out of tracking for purposes like behavioral advertising.

Frequently Asked Questions

- + What is Do Not Track?
- + Is Do Not Track available on Firefox for Android?
- + Does Do Not Track block ads?
- + How does Do Not Track work with other privacy tools?
- + Will Do Not Track affect the rest of my Web

Do Not Track
Your Status:
Do Not Track is ON

Enable Do Not Track in Firefox

General	Tabs	Content	Ap
Tracking			
<input checked="" type="checkbox"/> Tell web sites I do not want to be			

[Click for Instructions »](#)

Enable Do Not Track in Internet Explorer 9

To enable Do Not Track in IE 9, you need to enable IE 9's [Tracking Protection](#) feature. The easiest way to do that is to install [Mozilla's Simple Tracking Protection List](#). If you view this page in IE 9, there will be instructions right here.

Third-party cookies

- Site A's page requests a third-party resource (image, script, iframe)
 - Normally, browser sends cookie associated with that third-party in that request



Third-party cookies

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Roll over image to zoom in

First Response Early Result Pregnancy Test, 3 tests, Packaging May Vary

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★★★★★ 486 customer reviews | 17 answered questions

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amazon students 47 Amazon Students rated this highly ★★★★★

List Price: \$49.57

Price: **\$12.98** Prime & Free Returns. Details

You Save: \$6.59 (34%)

Note: Available at a lower price from [other sellers](#), potentially without free Prime shipping.

In Stock.

Ships from and sold by Amazon.com. Gift-wrap available.

Want it Tuesday, March 24? Order within **29 hrs 56 mins** and choose **One-Day Shipping** at checkout. Details

Package Quantity: 1

1	2	3
\$12.98 Prime	\$41.00 Prime	\$57.99

Customers Who Bought This Item Also Bought

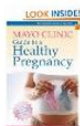
Page 6 of 14 | [Start over](#)



Vitafusion Prenatal DHA and Folic Acid Gummy Vitamins, 180 Count
★★★★☆ 140
\$20.25 Prime



One A Day Women's Prenatal One Pill, 30 Count
★★★★☆ 18
\$13.48 Prime



Mayo Clinic Guide to a Healthy Pregnancy:... the pregnancy experts...
★★★★☆ 804
#1 Best Seller in Motherhood



Summer's Eve Cleansing Wash, Morning Paradise, 15 Ounce
★★★★☆ 44
\$3.99



Nexcare 524560 Basal Digital Thermometer
★★★★☆ 19
\$14.06 Prime



Nature Made Prenatal Multi Vitamin Value Size, Tablets, 250-Count
★★★★☆ 213
\$16.79 Prime



Trojan Condom Pleasure Pack Lubricated, 40 Count
★★★★☆ 126
\$18.12 Prime



XKEYSCORE

TOP SECRET//COMINT//REL TO USA, AUS, CAN, GBR, NZL

What is XKEYSCORE?



1. DNI Exploitation System/Analytic Framework
 2. Performs strong (e.g. email) and soft (content) selection
 3. Provides real-time target activity (tipping)
 4. "Rolling Buffer" of ~3 days of ALL unfiltered data seen by XKEYSCORE:
 - Stores full-take data at the collection site – indexed by meta-data
 - Provides a series of viewers for common data types
-
1. Federated Query system – one query scans all sites
 - Performing full-take allows analysts to find targets that were previously unknown by mining the meta-data

TOP SECRET//COMINT//REL TO USA, AUS, CAN, GBR, NZL

XKEYSCORE



OPTIC NERVE

SECRET STRAP1

Reference: B/7199BA/5001/5/114

Date: December 2008

Copy no:

Issued by: B18, GCHQ

OPTIC NERVE – Yahoo Webcam display and target discovery



Summary

A report on the development of OPTIC NERVE – a web interface to display Yahoo Webcam images sampled from unselected intercept and a system for proportionate target discovery



Right to be Forgotten

- Recent law in the EU
 - Individuals can compel Google to remove results for them
 - Currently only applies to EU TLDs;
 - results removed from **google.co.uk** still returned on **google.com**

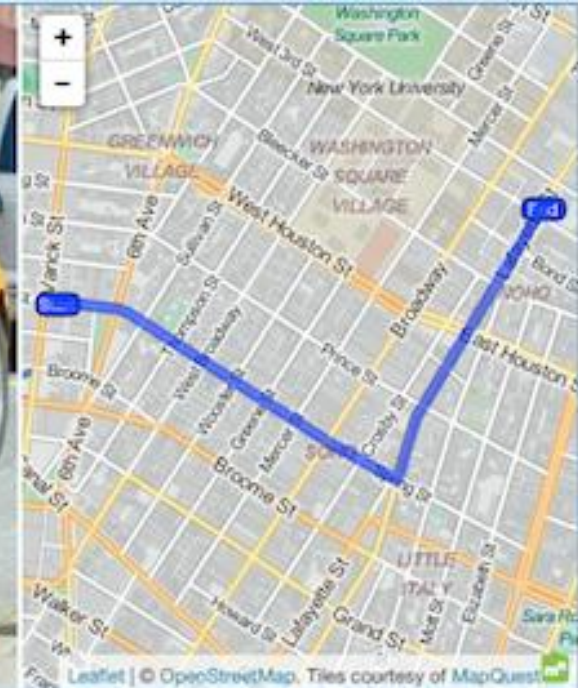
NYC Taxi Data



NYC Taxi Data

```
trip_data_1.csv
1 medallion, hack_license, vendor_id, rate_code, store_and_fwd_flag,
  pickup_datetime, dropoff_datetime, passenger_count, trip_time_in_secs,
  trip_distance, pickup_longitude, pickup_latitude, dropoff_longitude,
  dropoff_latitude
2 89D227B655E5C82AECF13C3F540D4CF4,BA96DE419E711691B9445D6A6307C170,CMT,1,N,2013-01-
  01 15:11:48,2013-01-01 15:18:10,4,382,1.
  00,-73.978165,40.757977,-73.989838,40.751171
3 0BD7C8F5BA12B88E0B67BED28BEA73D8,9FD8F69F0804BDB5549F40E9DA1BE472,CMT,1,N,2013-01-
  06 00:18:35,2013-01-06 00:22:54,1,259,1.50,-74.006683,40.731781,-73.994499,40.75066
4 0BD7C8F5BA12B88E0B67BED28BEA73D8,9FD8F69F0804BDB5549F40E9DA1BE472,CMT,1,N,2013-01-
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5 DFD2202EE08F7A8DC9A57B02ACB81FE2,51EE87E3205C985EF8431D850C786310,CMT,1,N,2013-01-
  07 23:54:15,2013-01-07 23:58:20,2,244,.70,-73.974602,40.759945,-73.984734,40.759388
6 DFD2202EE08F7A8DC9A57B02ACB81FE2,51EE87E3205C985EF8431D850C786310,CMT,1,N,2013-01-
  07 23:25:03,2013-01-07 23:34:24,1,560,2.10,-73.97625,40.748528,-74.002586,40.747868
7 20D9ECB2CA0767CF7A01564DF2844A3E,598CCE5B9C1918568DEE71F43CF26CD2,CMT,1,N,2013-01-
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  15:38:37,1,648,1.70,-73.966743,40.764252,-73.983322,40.743763
8 496644932DF3932605C22C7926FF0FE0,513189AD756FF14FE670D10B92FAF04C,CMT,1,N,2013-01-
  08 11:01:15,2013-01-08 11:08:14,1,418,.80,-73.995804,40.743977,-74.007416,40.744343
9 0B57B9633A2FECD3D3B1944AFC7471CF,CCD4367B417ED6634D986F573A552A62,CMT,1,N,2013-01-
  07 12:39:18,2013-01-07
  13:10:56,3,1898,10.70,-73.989937,40.756775,-73.86525,40.77063
10 2C0E91FF20A856C891483ED63589F982,1DA2F6543A62B8ED934771661A9D2FA0,CMT,1,N,2013-01-
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11 2D4B95E2FA7B2E85118EC5CA4570FA58,CD2F522EEE1FF5F5A8D8B679E23576B3,CMT,1,N,2013-01-
  07 15:33:28,2013-01-07 15:49:26,2,957,2.50,-73.977936,40.786983,-73.952919,40.80637
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```

NYC Taxi – Tracking Celebrities



Bradley Cooper

Jessica Alba

AOL Search Data Leak

98280	prayers to break curses	2006-04-09 5	
98280	prayers for cleansing	2006-04-09 2	5820892 i do not believe that my daughter is a les
98280	prayers for defeating enemy	2006-04-09 1	5820892 i do not like to be asked my age
98280	bible scriptures for defeating the enemy	2006-04-09 4	5820892 i lost 50 pounds with zetacap
98280	prayers to plead the blood of jesus against problems	2006-04-09 2	5820892 i lost weight with zetacap
98280	prayers to plead the blood of jesus against problems	2006-04-09 1	5820892 i too zetacap and it did not work
98280	prayers to plead the blood of jesus against problems	2006-04-09 3	5820892 i paid a lot of money for the healing code
98280	how does a male's cocaine use affect a fetus	2006-04-10 1	5820892 i stopped my lesbian behavior
98280	how does a male's cocaine use affect a fetus	2006-04-10 5	5820892 i was a lesbian for only 5 years
98280	birth defects caused by father's cocaine use	2006-04-10 1	5820892 i was brainwashed in to thinking i was a l
98280	birth defects caused by father's cocaine use	2006-04-10 4	5820892 i was confused about my sexuality for a co
98280	are chainletter scams ever successful	2006-04-10 0	5820892 i was fooled into thinking i was a lesbian

4417749 clothes for age 60
 4417749 60 single men
 4417749 best retirement city
 4417749 jarret arnold
 4417749 jack t. arnold
 4417749 jaylene and jarrett arnold
 4417749 gwinnett county yellow pages
 4417749 rescue of older dogs
 4417749 movies for dogs
 4417749 sinus infection

3062186 13092352	habe 20ruth 2006-03-11 14:32:51	279971 www.princessmissygirl.com	2006-03-02 0
3062187 13092352	amazon 20.com 2006-03-11 15:13	279971 moves of a stripper	2006-03-02 3
3062188 13092352	amazon.com 2006-03-11 15:15:49	279971 moves of a stripper	2006-03-02 5
3062189 13092352	priceline.com 2006-03-14 12:23:21	279971 get the body of a stripper	2006-03-02 0
3062190 13092352	priceline.com 2006-03-18 15:11:11	279971 tighten inner thighs	2006-03-02 1
3062191 13092352	newark 20airport 2006-05-22 15:1	279971 tighten inner thighs	2006-03-02 1
3062192 13092352	- 2006-05-22 15:44:32	279971 be comfortable walking	2006-03-02 5
3062193 13092352	newark airport 2006-05-22 15:47	279971 be comfortable walking	2006-03-02 0
3062194 13092352	newark airport 2006-05-22 15:47	279971 around naked	2006-03-02 4
3062195 13092352	car 20rental 2006-05-22 15:55:01	279971 missionary position	2006-03-02 1
3062196 13092352	car rental 2006-05-22 15:56:13	279971 dubai control of u.s. ports	2006-03-02 4
3062197 13092352	car rental 2006-05-22 15:56:16		
3062198 13092352	dollar 20rent 20a 20car 2006-05-2		
3062199 13092589	excel rim 2006-03-11 13:50:26		
3062200 13092589	google 2006-03-12 02:04:12 1 ht		
3062201 13092589	excel rim 2006-03-12 02:21:43		
3062202 13092589	excel rim 2006-03-12 02:22:13		
3062203 13092589	excel dirt bike rim 2006-03-12		
3062204 13092589	google 2006-04-09 22:25:39 1 ht		
3062205 13092589	ak47sale 2006-04-09 23:38:29		
3062206 13092589	ak47sale 2006-04-09 23:38:49		
3062207 13092589	guns 2006-04-09 23:39:11		

AOL Search Data Leak

A Face Is Exposed for AOL Searcher No. 4417749

By MICHAEL BARBARO and TOM ZELLER Jr.
Published: August 9, 2006

Buried in a list of 20 million Web search queries collected by AOL and recently released on the Internet is user No. 4417749. The number was assigned by the company to protect the searcher's anonymity, but it was not much of a shield.



Erik S. Lesser for The New York Times
Thelma Arnold's identity was betrayed by AOL records of her Web searches, like ones for her dog, Dudley, who clearly has a problem.

Multimedia

Graphic: What Revealing Search Data Reveals

No. 4417749 conducted hundreds of searches over a three-month period on topics ranging from “numb fingers” to “60 single men” to “dog that urinates on everything.”

And search by search, click by click, the identity of AOL user No. 4417749 became easier to discern. There are queries for “landscapers in Lilburn, Ga,” several people with the last name Arnold and “homes sold in shadow lake subdivision gwinnett county georgia.”

It did not take much investigating to follow that data trail to Thelma Arnold, a 62-year-old widow who lives in Lilburn, Ga., frequently researches her friends' medical ailments and loves her three dogs. “Those are my searches,” she said, after a reporter read part of the list to her.

AOL removed the search data from its site over the weekend and apologized for its release, saying it was an unauthorized move by a team that had hoped it would benefit academic researchers.

But the detailed records of searches conducted by Ms. Arnold and 657,000 other Americans, copies of which continue to circulate online, underscore how much people unintentionally reveal about themselves when they use search engines — and how risky it can be for companies like AOL, [Google](#) and [Yahoo](#) to compile such data.

Those risks have long pitted privacy advocates against online marketers and other

SIGN IN TO E-MAIL THIS

PRINT

REPRINTS



Data Privacy Defenses

- k-anonymity
 - Ensure that each record is *indistinguishable* from at least $k - 1$ other records.
 - Remove quasi-identifiers (e.g., ZIP, DOB, etc)
 - e.g., reduce granularity (partial zip codes, year of birth)

k-anonymity

ZIP	DOB	Disease
902**	1984	Cancer
902**	1984	Cancer
902**	1984	Cancer
902**	1957	Heart Disease
902**	1957	GI Disease
902**	1957	Died of poison apple
904**	1978	Heart Disease
904**	1978	Cancer
904**	1978	Cancer

Differential Privacy

- Instead of providing whole data set, provide an **algorithm** for answering queries:
 - A differentially private algorithm is insensitive to single-row changes
 - $[A(S)]$ $[A(S')]$
 - Basically, add (bounded) noise to $A()$
- Computation of $A()$ happens at dataset
- Noise: tradeoff between usability and privacy
- But allows us to bound how much information is revealed

Differential Privacy

