

# Hello!



# 2.8 billion photos



# 2.8 billion photos











http://www.flickr.com/photos/plasticbag/2829222745/





Organize - Contacts -

Groups -

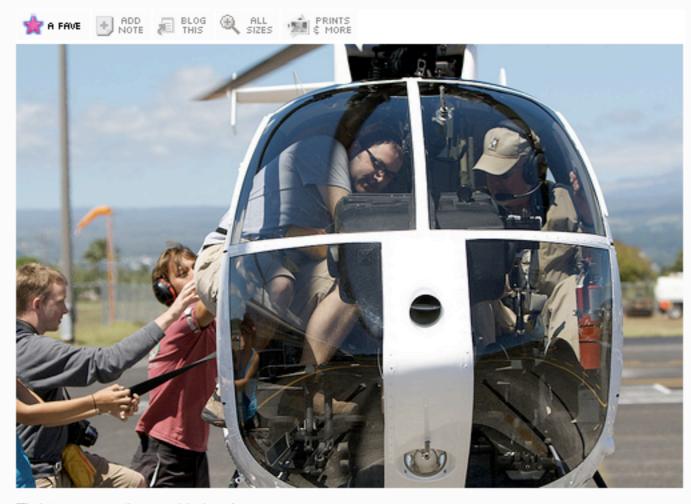
Explore -

Search | -

Share This 👘

(385 new) Help

### It took a team of helpers to get Cal into the helicopter!



Tight squeeze there, old chap!

#### Comments



Tom Coates pro says:

Ok, I'll come clean - he didn't need to be squeezed in at all. Is funny optical illusion. Or that's my story at least.

Posted 2 weeks ago. ( permalink )



Amy Hammond pro says:

#### Uploaded on September 4, 2008 by Tom Coates



#### This photo also belongs to:

- + Holiday in Hawaii (Set)
- + Most Interesting Photos (Set)
- + Life Journey (Pool)

#### Tags

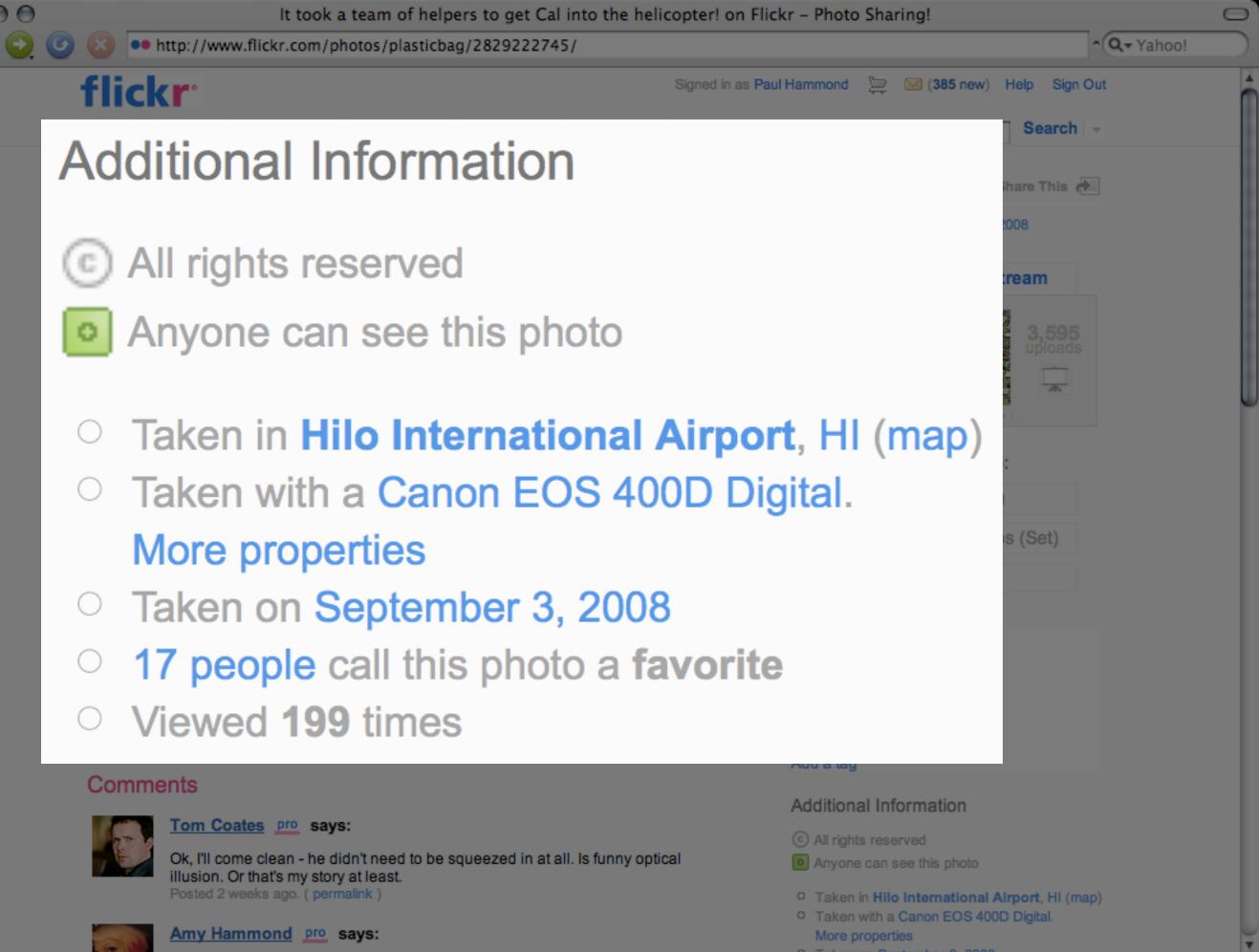
Signed in as Paul Hammond

- calhenderson
- paulhammond
- helicopter
- hiloairport

#### Add a tag

#### Additional Information

- © All rights reserved
- Anyone can see this photo
- Taken in Hilo International Airport, HI (map)
- Taken with a Canon EOS 400D Digital. More properties
- O. Taken on Sentember 3, 2008



U Takan on Santambar 4 7/1/18

# UPDATE Photos SET count\_views = count\_views + 1 WHERE id = 2848768996

## Idea:

More info on how and when your photos are viewed

The team







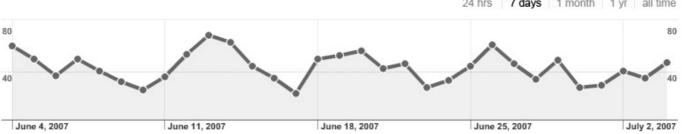


Design ideas

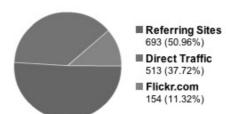


#### Stats



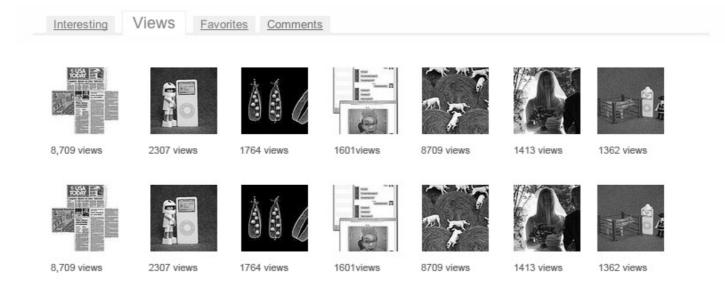


#### Referrers in the last 7 days



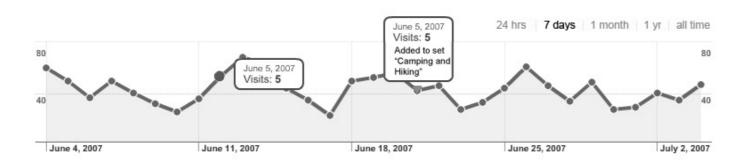
All	Flickr Referring	
1	flickr.com/groups/cheeses/	26,098
2	flickr.com/photos/dunstan/	14,431
3	google.com	12,854
4	flickr.com/people/dunstan/	400
5	twitter.com	389
6	msn.com	78
7	virb.com	77
8	foo.com	54
9	bar.com	32
10	poop.com	8

#### Popular photos in the last 7 days





#### Stats for "My new iPod nano 1"



ews of diffe	erent sizes	Referrers				
hoto page	21945					All Flickr Referring
Medium page	6		■ Referring Sites 693 (50.96%)		1	5-50 to
Large page	196		■ Direct Traffic		2	
Original page	86		513 (37.72%)  Flickr.com		3	3 google.com
ong page			154 (11.32%)	4	1	flickr.com/people/dunstan/
				5		twitter.com
				6		msn.com
				7		virb.com
				8		foo.com
				9		bar.com
				10		poop.com

#### Blogged

- 1 http://filio.com/blog/bee-boo.html
- 2 http://www.monkey.org/monkeydoo/

#### Favorited

Plura Bella added this as a favorite on 25 Mar 07, 12.23AM PDT.

johnengler added this as a favorite on 18 Mar 07, 12.20PM PDT.

browse

jasongoldman [x]
hankmason [x]

Additional Information

© All rights reserved (edit)

See different sizes

· Stats Illilililling and all at

Taken on July 1, 2007 (edit)

3 people call this photo a favorite
 Viewed 21 times (Not including you)

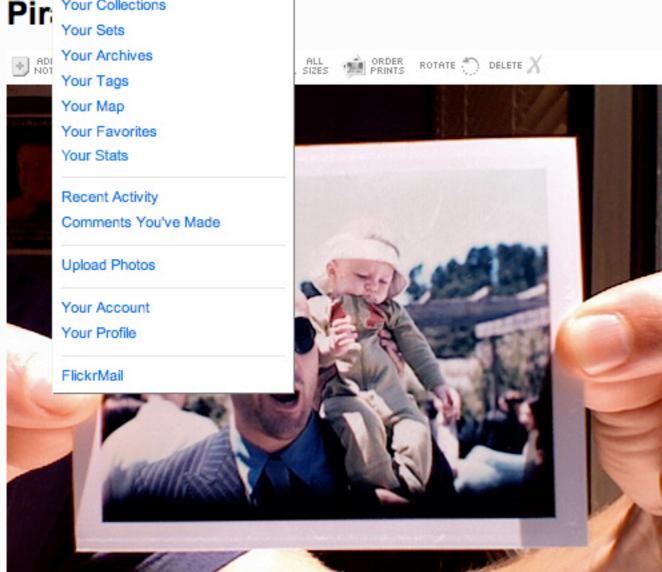
Edit title, description, and tags
 Replaced on July 1, 2007

This photo is public (edit)

Picnik [x]
polaroid [x]
210 [x]

Add a tag

Tags



#### Jason and Hank.

This photo has notes. Move your mouse over the photo to see them.

#### Add your comment

(Some HTML is OK.)

(Some HTML is OK.)

This photo is public (edit)



#### Stats for: Z28



All referrers...

All referrers...



#### Stats for your account



Views: 48 today / 212 this week / 456 this month / 26784 all time



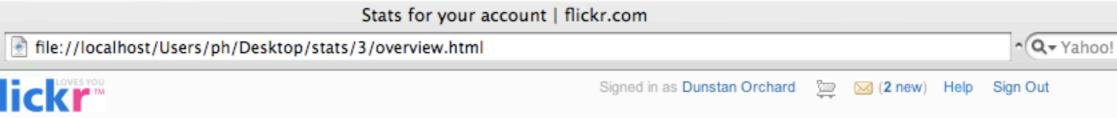
#### Meta information

Uploaded 3 photos today, 14 photos this week.

#### Further stats

- Photostream stats
- Sets stats
- Collections stats





Search everyone's photos

Search -



flickr\*

000

## Stats for your account

Organize - Contacts - Groups - Explore -



photostream views: 56 today / 312 this week / 567 this month / 32,984 all time

Your most viewed photos today	
Floating	7 favs / 9 cmnts / <b>431 views</b>
Jellyfish	14 favs / 5 cmnts / <b>289 views</b>
Pirate and Parrot	0 favs / 14 cmnts / <b>80 views</b>
Hey	1 favs / 3 cmnts / 65 views

Your most viewed photos this month				
Floating	7 favs / 9 cmnts / <b>431 views</b>			
Jellyfish	14 favs / 5 cmnts / 289 views			
Pirate and Parrot	0 favs / 14 cmnts / <b>80 views</b>			
🤼 Hey	1 favs / 3 cmnts / 65 views			



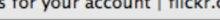
f	Flickr	26,098	<u>f</u>	Flickr	26,098
3	Google	12,845	G	Google	12,845
	twitter.com	389	t	twitter.com	389
ø	MSN	78	W	MSN	78
10.	virb.com	77	Vina*	virb.com	77
	foo.com	54		foo.com	54
	bar.com	32		bar.com	32
	poop.com	8		poop.com	8
	bar.com	32		bar.com	32
	poop.com	8		poop.com	8

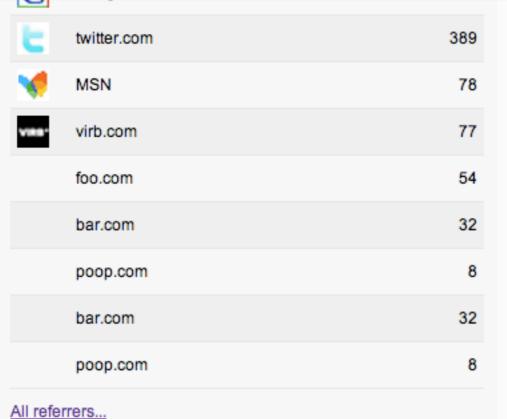
000

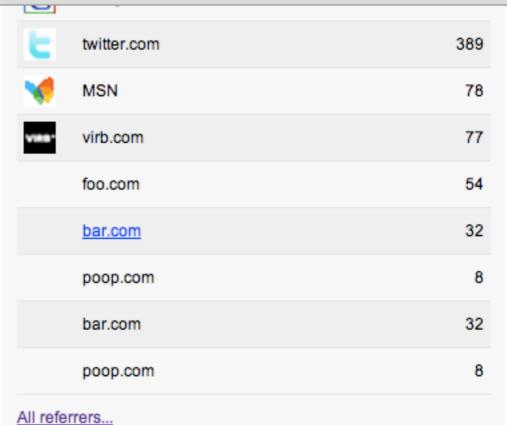
Jellyfish

Top referrers today

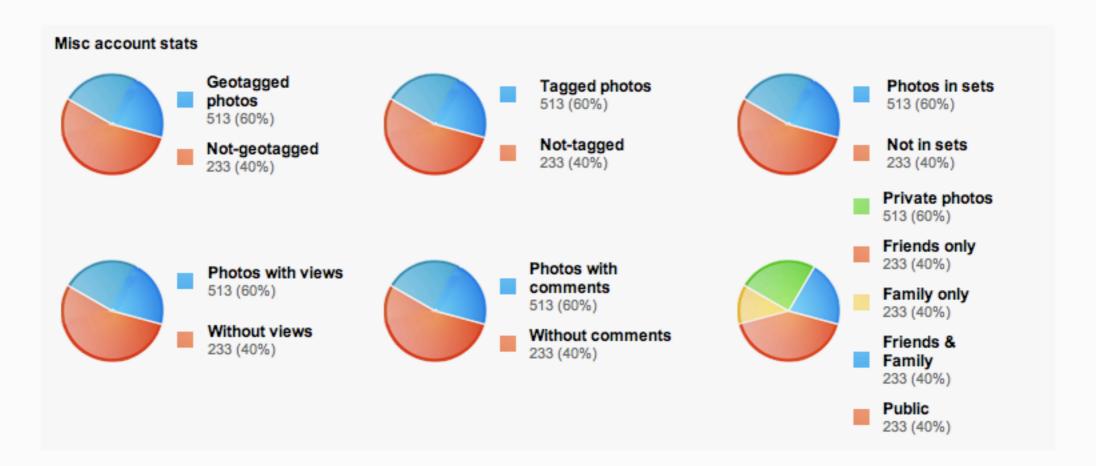
More...







^ Q - Yahoo!



## 2 obvious challenges:

Drawing graphs & Storing all the data

# MySQL (our preferred hammer)

## Referrers

```
week_start
 owner_id
 photo_id
   referrer
      mon
       tue
      wed
       thu
        fri
       sat
       sun
      total
```

### Referrers

```
week_start
             1222041600
 owner_id
             5806
 photo_id
             2839428829
   referrer
             google.com/search?q=sunset
             0
      mon
             0
       tue
             2
      wed
       thu
             0
        fri
             4
             0
       sat
             0
       sun
      total
             6
```

## INSERT INTO Referrers (week\_start,photo\_id,owner\_id,referrer,tuesday,total)

### **VALUES**

(1222041600,2839428829,5806,'google.com/',1,1)

# INSERT INTO Referrers (week\_start,photo\_id,owner\_id,referrer,tuesday,total)

### **VALUES**

(1222041600,2839428829,5806,'google.com/',1,1)

## ON DUPLICATE KEY UPDATE

tuesday = tuesday + 1, total = total + 1

SELECT \* FROM Referrers
WHERE
photo\_id = 1234
AND
week\_start = 1222041600
AND
wednesday!= 0

# SELECT SUM(total) FROM Referrers WHERE photo\_id = 1234

## Problem:

Data growing at more than 100 gigabytes every week

300 gigabytes per server

3 weeks data

Solution:

Sharding



```
/* on main database */
SELECT stats_cluster FROM Accounts
WHERE id = 12345
```

```
/* on stats cluster 3 */
SELECT * FROM Referrers WHERE ...
```

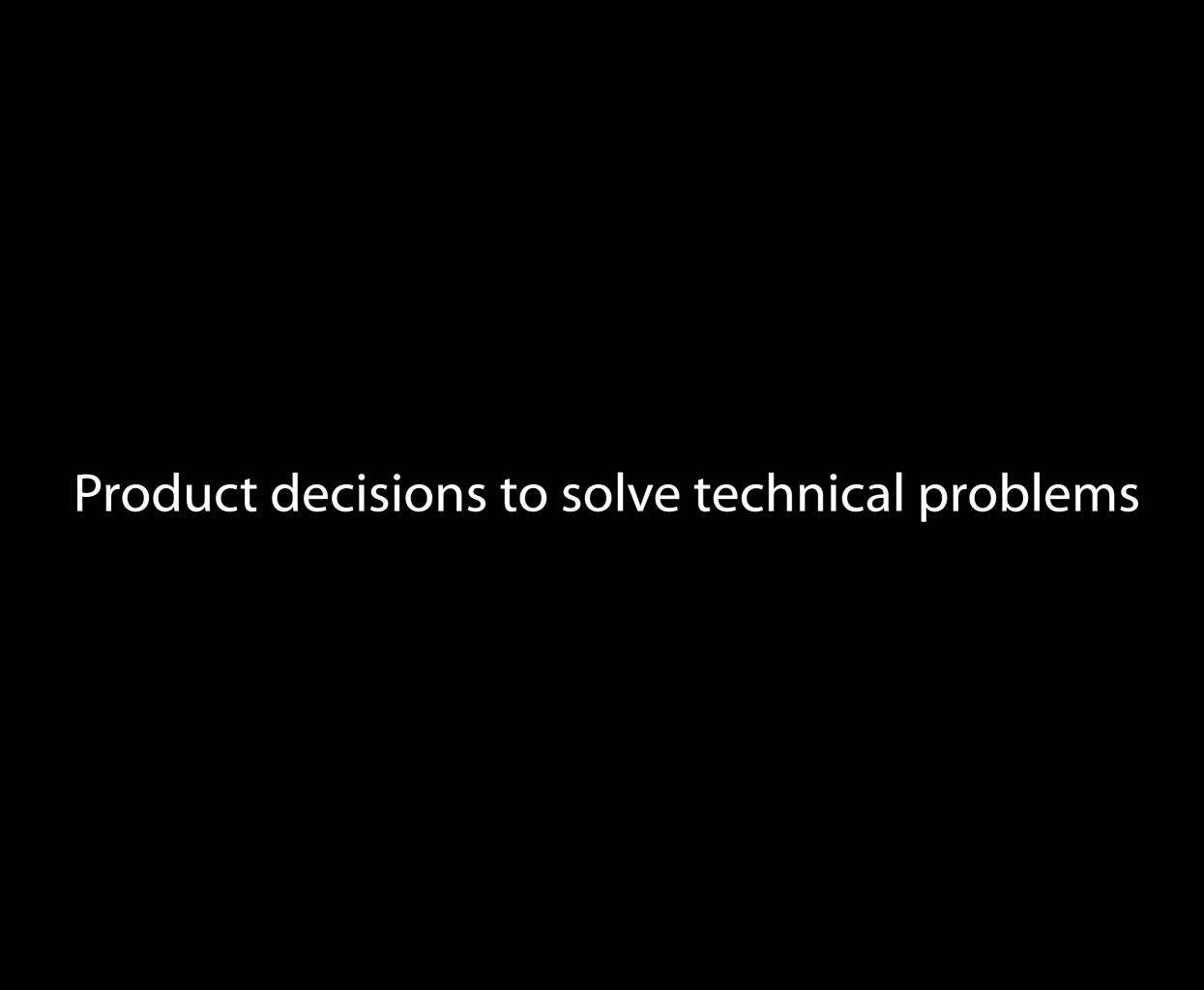
# Need more disk space? Add more servers and move some accounts

Data still growing at 100 Gigabytes per week

Make the feature Pro Only

# Now "only" growing at 30 GB / Week

(note: you can't infer how many pro users we have from these numbers)



Data growing at 30 Gigabytes per week and we need all of it for all time counts

Put all time counts in a second table

#### ReferrersTotals

owner\_id 5806

photo\_id 2839428829

referrer google.com/search?q=sunset

total 6

Do two inserts on every page load

```
INSERT INTO Referrers (...)
VALUES (...) ON DUPLICATE KEY UPDATE ...;
INSERT INTO ReferrersTotals (...)
```

VALUES (...) ON DUPLICATE KEY UPDATE ...;

Delete daily data older than 5 weeks

2 tables get out of sync

# If you display two numbers that don't add up someone will notice

Wrap the inserts in a transaction

#### BEGIN TRANSACTION;

```
INSERT INTO Referrers (...)
VALUES (...) ON DUPLICATE KEY UPDATE ...;
```

```
INSERT INTO Referrers Totals (...)
VALUES (...) ON DUPLICATE KEY UPDATE ...;
```

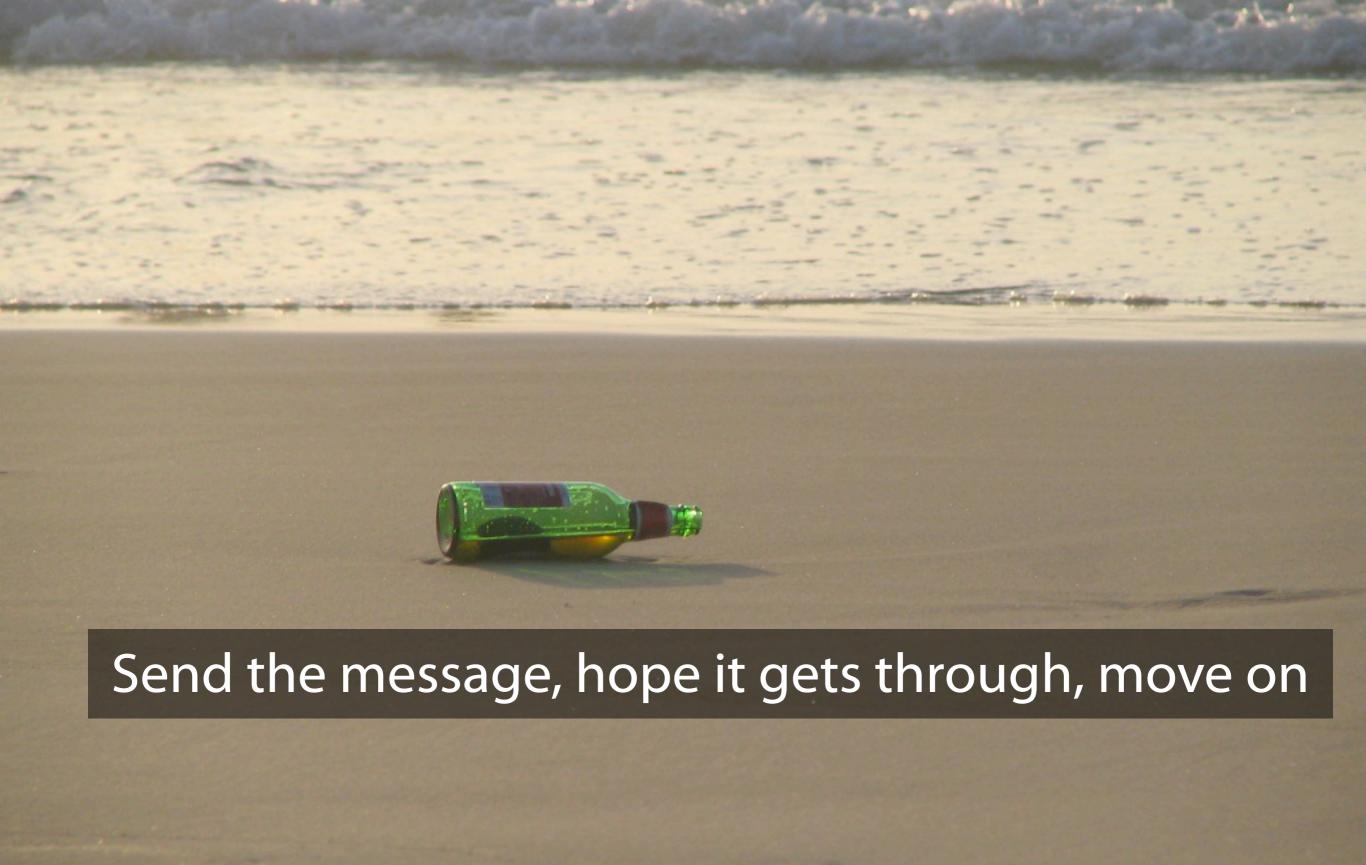
**COMMIT**;

(btw: we're hiring DBAs)

Writing stats data slows down page generation times for viewers



Deferred writes





Web Server Delayed Database Daemon

Web Server Delayed Database Daemon

this bit is fast

Reading data is too slow

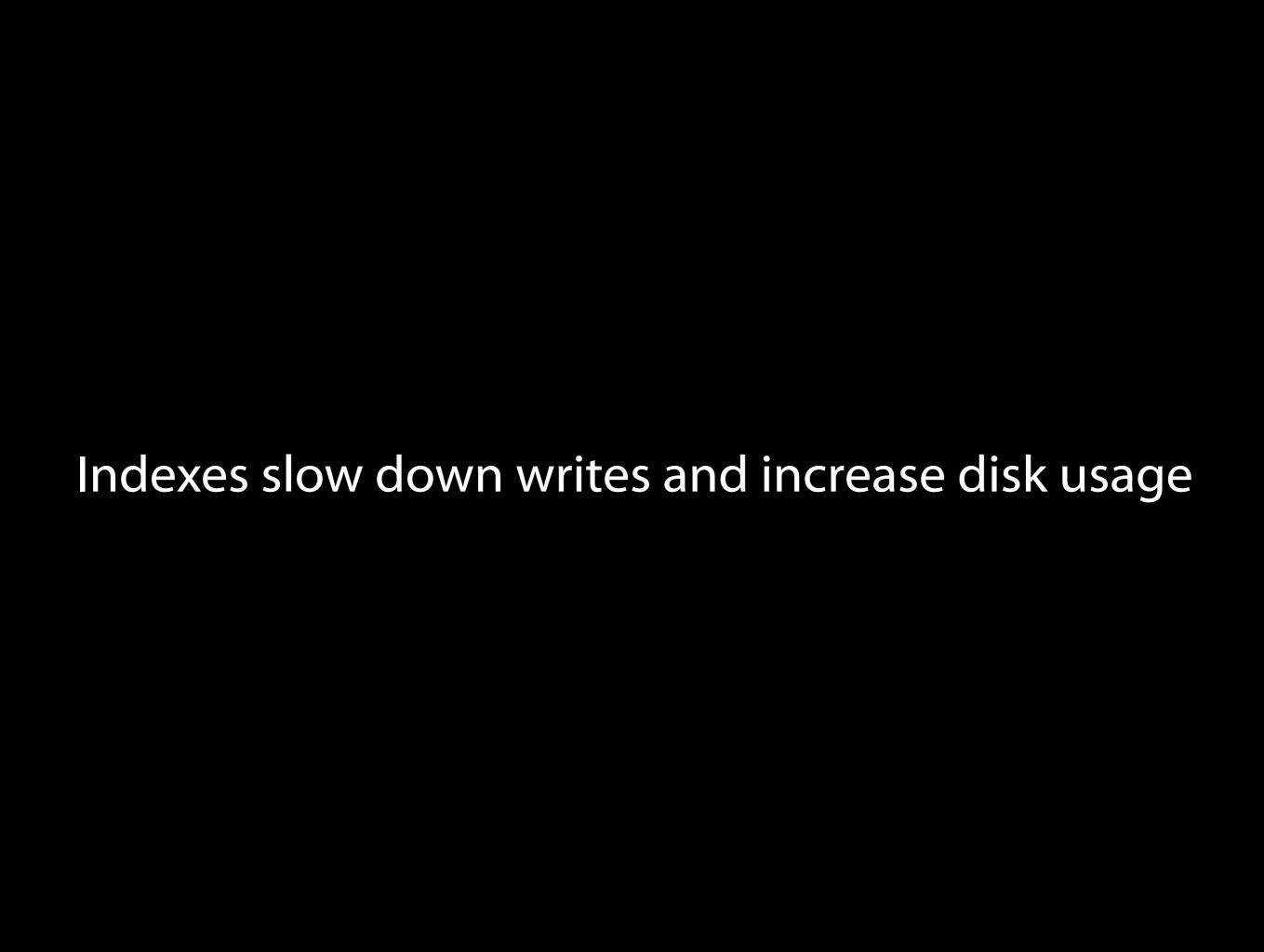
Indexes

# Without indexes, MySQL will check every single row to see if it matches the WHERE clause http://flickr.com/photos/audreyjm529/155024495/



# Flickr Engineering Rule: No unindexed queries in public pages

Limit on how many columns we can index



**Batch Processing** 





# Every night, read in all of yesterday's data and create summary tables

# Flickr Engineering Rule: No unindexed queries in public pages

### Flickr Engineering Rule: No unindexed queries in public pages

### SELECT SUM(monday) AS count FROM Referrers WHERE owner\_id = 12 AND week\_start = 1222041600

INSERT INTO graphviews (user\_id, date, views)

VALUES

(12, '2008-09-22', 134)

Problem:

Still too much data!

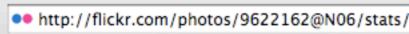
### Solution:

Make people ask for stats

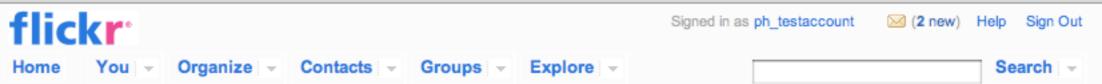












# Flickr, now with 100% more statistical goodness!

Here's what you'll be able to do...

- Be enthralled by graphs and charts!
- Learn which of your photos are popular today, this week, or over all time
- Oiscover where your visitors are coming from
- See how they found you
- 5 Thrill at a helpful breakdown of your photos

### Want your stats?

#### Yes! Activate me!

We're only crunching numbers for members who ask, so click the big button if you want in.

#### Account overview



#### Individual photos



# Another product decision solving a technical problem

### Problem:

"But can we have 4 weeks of data ready for them when they upgrade?"

Solution:

Cheaper storage



# No live queries, no indexes just record data for 4 weeks

### **MyISAM**

InnoDB

table level locking occasionally corrupts insanely fast reads low disk/memory usage no transactions

row level locking
almost never corrupts
better read/write performance
high disk/memory usage
transactions

mysql default

the right choice (most of the time)

# Flickr Engineering Rule: Use InnoDB

We used MyISAM

### Problem:

Moving data between systems takes a long time

Solution:

Offline tasks



# MySQL (still our preferred hammer)

# INSERT INTO OfflineTasks (id, type, args, date\_create) VALUES

(12345, 'stats\_upgrade', '5806', 1221659081)

```
function offline_stats_upgrade($task){
    $user_id = $task["args"];

# do the upgrade here

return "ok";
}
```

# SELECT \* FROM OfflineTasks ORDER BY date\_create LIMIT 1

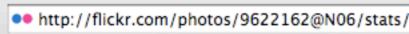
```
$row = db_query("SELECT * FROM Offline...");
$func = "offline_{$row[type]}";
call_user_func_array($func, array($row));
```

**DELETE FROM OfflineTasks WHERE id = 12345** 

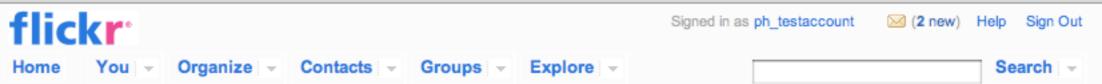












# Flickr, now with 100% more statistical goodness!

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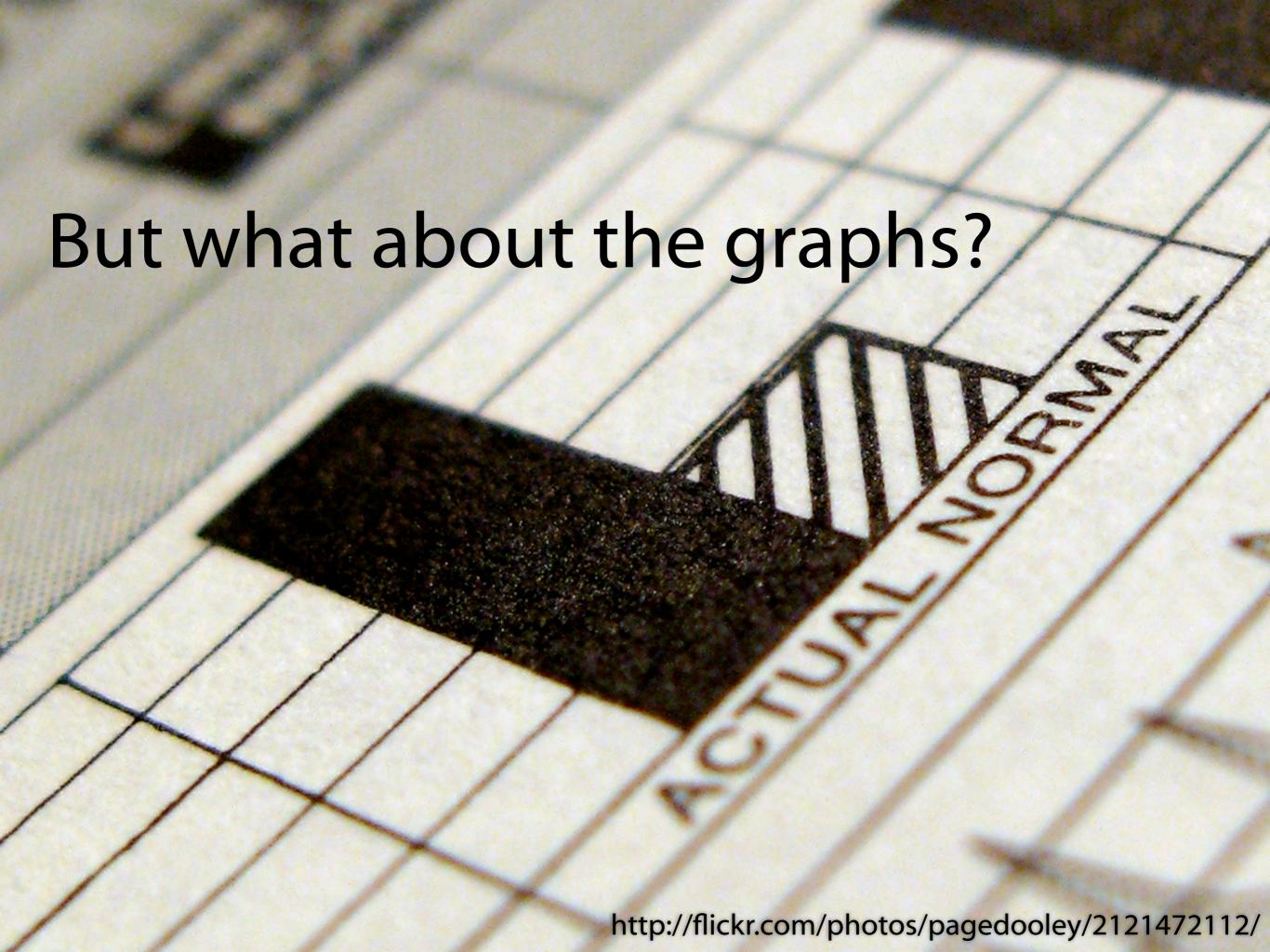
#### Account overview



#### Individual photos



Offline tasks are incredibly useful



### Server Side: ImageMagick, GD, Batik etc

















#### Sparkline PHP Graphing Library

Home FAQ Wiki Download CVS

#### What Are Sparklines?

Sparklines are "intense, simple, wordlike graphics" so named by Edward Tufte. In lieu of a more detailed introduction, Professor Tufte's site has an early release of a chapter on sparklines.

#### Examples

Back in the dot-com heyday, you might remember that Cisco, EMC, Sun, and Oracle were nicknamed "the four horsemen of the Internet". You might now say: "companies that ride together, slide together." Large 10-year charts of these four stocks.



I'm a Yankees fan, having grown up in New York. Unless you abhor baseball or were living under a rock in October 2004, you may remember the Yakees had some trouble in the postseason אוווין. The Red Sox responded to a bad start וועווען to win the ALCS and World Series in 8 straight wins.

Yankees fan or Red Sox fan, Republican or Democrat, the growing US deficit is a grave concern in the coming years. A strong economy helped push down the deficit during the Clinton presidency. After President Bush's first term and a costly war on terror, the picture is not so rosy. OMB data shows the ebb and flow of the deficit from 1983 - 2003.

#### Mission

We aim to increase the adoption of sparklines on the web by providing a high-quality PHP sparkline library with the following properties:

- Flexible While Sparkline is not a general-purpose graphing library, we do provide a wide range of options how your graphs are rendered. Version 0.1 supports line and bar modes, which allow for simple line, filled line, bar, and whisker graphs.
- Elegant It's important that sparklines are visually appealing, especially in the restricted visual environment of the web. Web sparklines should approach as closely as possible the aesthetic of printed sparklines.
- Free Sparkline is completely free to use on your personal website, company home page, or to include in your commercial product. Sparkline is distributed under the BSD license.

#### News

- 10 November 2007 Version 0.3 "South Hayward" is under development. More news to follow.
- 3 June 2005 I've opened a sparkline wiki at Wikispaces for discussion and documentation of this library. Please join us to help share knowledge of the library and experiences with sparklines in the wild.
- 2 June 2005 Version 0.2 "Union City" has been tagged in CVS and released on SourceForge. This version addresses several bugs found in version 0.1. Notably, small data sets rendered using line mode are fixed. This version has undergone substantially more real-world testing and can now be considered beta quality.

### Client Side: Flash, Canvas, SVG, Silverlight













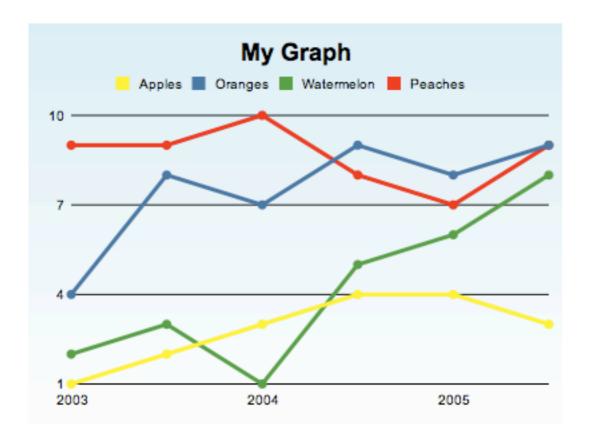




Download v0.3.4 **API** reference

Bluff is a JavaScript port of the Gruff graphing library for Ruby. It is designed to support all the features of Gruff with minimal dependencies; the only third-party scripts you need to run it are a copy of JS.Class (about 2kb gzipped) and a copy of Google's ExCanvas to support canvas in Internet Explorer. Both these scripts are supplied with the Bluff download. Bluff itself is around 8kb gzipped.

To draw a graph, you create a new Bluff graph object using the id of a canvas element on the page, set some options, add the data and labels, then tell the graph to draw. A basic example:



http://code.google.com/p/explorercanvas/

# Flickr uses most of these methods (and some others)

000	
	^Q ▼ Yahoo!

Search:

Hello ph [logout]

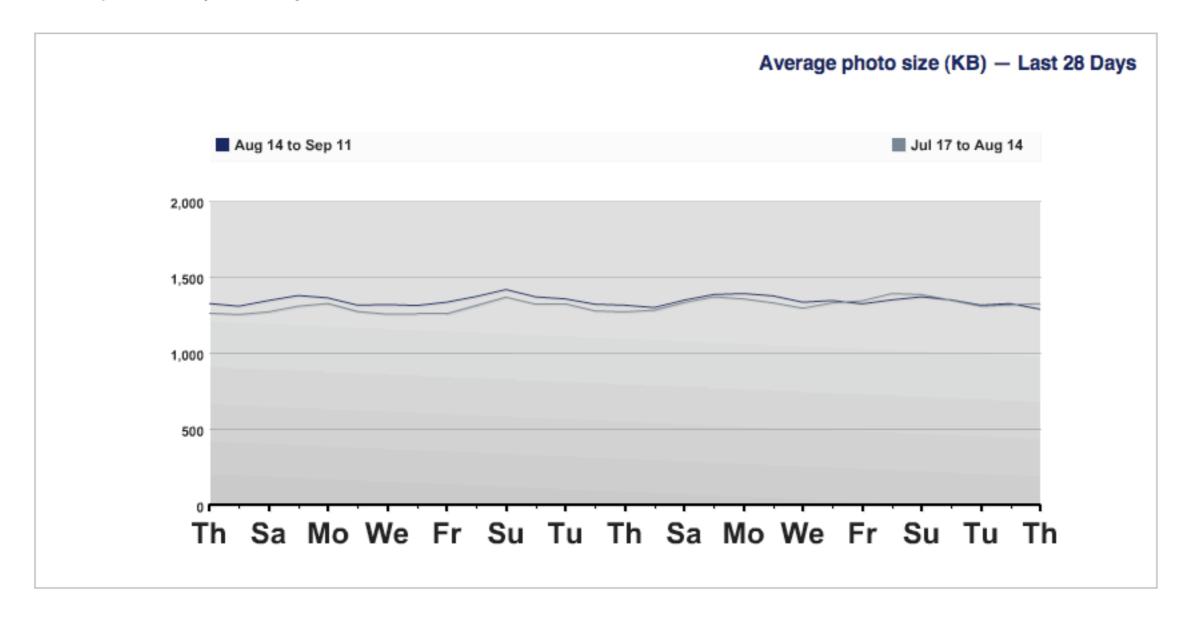
тос

Case #:

#### **Average Photo Upload Size**

View as spreadsheet (all records)

flickr.com



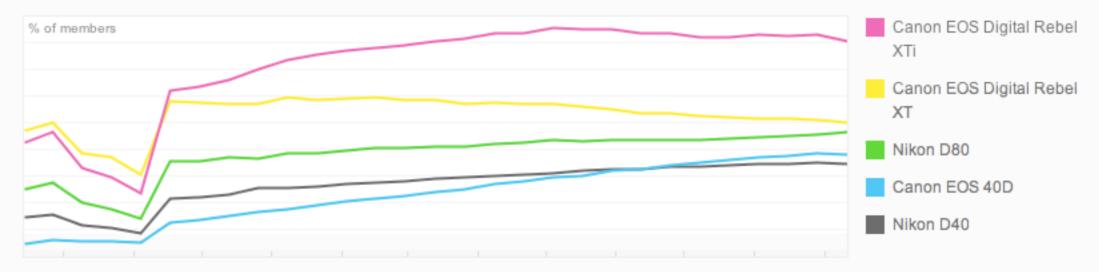




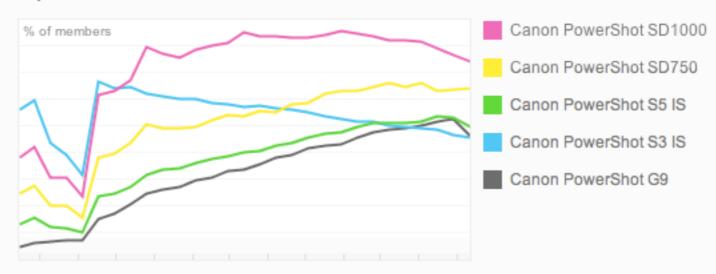




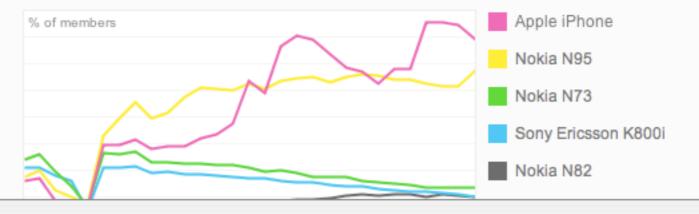
#### Most Popular Cameras in the Flickr Community



#### Popular Point & Shoot Cameras



#### **Popular Cameraphones**



#### About these graphs

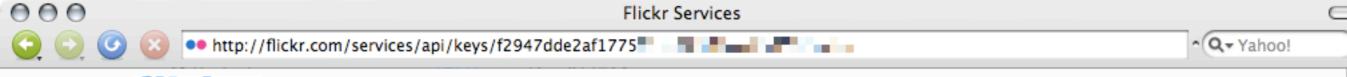
These graphs show the number of Flickr members who have uploaded at least one photo or video with a particular camera on a given day over the last year.

The graphs are "normalized", which is a fancy way of saying that they automatically correct for the fact that more people join Flickr each day: the graph moving up or down indicates a change in the camera's popularity relative to all other cameras used by Flickr members.

The graphs are only accurate to the extent that we can automatically detect the camera used to take the photo or shoot the video (about 2/3rds of the time). That is not usually possible with cameraphones, therefore they are under-represented.

Pricing and specifications provided by

# Same image for everyone so easy to generate once a night





#### Flickr Services

API Documentation Feeds Your API Keys Apply for a new API Key

#### API Key Stats for f2947dde2af1775

Number of authenticated users: 0

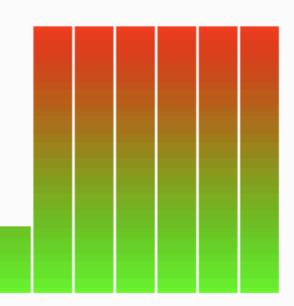
Total calls in the last hour: 0

Total calls in the last 24 hours: 75

#### Calls in the last day

Each bar represents the average QPS (queries per second) over an hour period.

Maximum hourly QPS in the last day: 0.0033



#### Calls in the last month

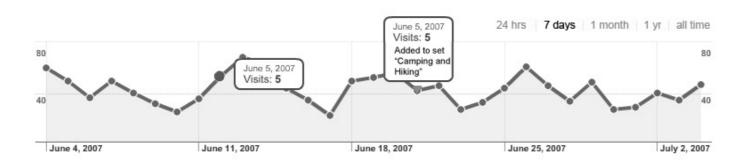
Each bar represents the average QPS (queries per second) over a 24 hour period.

Maximum daily QPS in the last month: 0.0034

```
<div
 class="bar"
 style="width: 29px; height: 183px;"
> </div>
<div
 class="bar"
 style="width: 29px; height: 300px;"
> </div>
```



#### Stats for "My new iPod nano 1"



ews of diffe	erent sizes	Referrers				
hoto page	21945					All Flickr Referring
Medium page	6		■ Referring Sites 693 (50.96%)		1	5-50 to
Large page	196		■ Direct Traffic		2	
Original page	86		513 (37.72%)  Flickr.com		3	3 google.com
ong page			154 (11.32%)	4	1	flickr.com/people/dunstan/
				5		twitter.com
				6		msn.com
				7		virb.com
				8		foo.com
				9		bar.com
				10		poop.com

#### Blogged

- 1 http://filio.com/blog/bee-boo.html
- 2 http://www.monkey.org/monkeydoo/

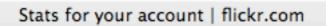
#### Favorited

Plura Bella added this as a favorite on 25 Mar 07, 12.23AM PDT.

johnengler added this as a favorite on 18 Mar 07, 12.20PM PDT.

# Javascript & Canvas: lightweight and easy to integrate with existing site Javascript















•• http://flickr.com/photos/paulhammond/stats/





Organize - Contacts - Groups -

Explore -

Signed in as Paul Hammond

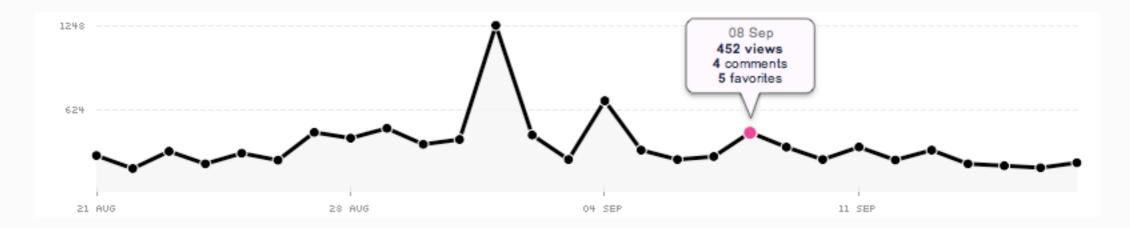
Search -

(387 new) Help



### Stats for your account Last updated: 7:19PM, 17 September 2008 PDT

#### Daily aggregate views on your account

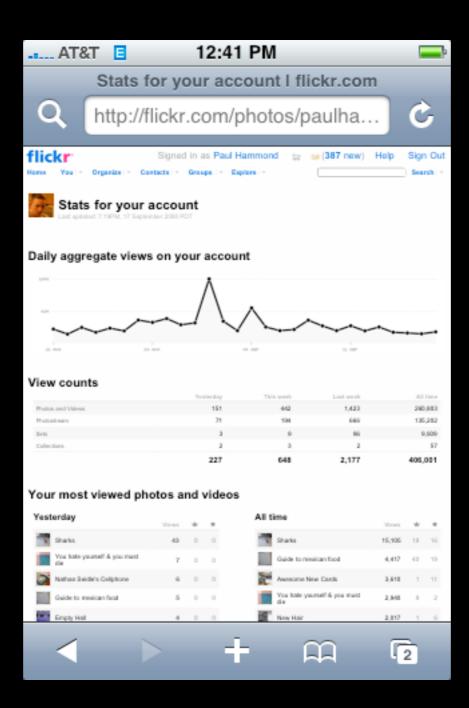


#### View counts

	Yesterday	This week	Last week	All time
Photos and Videos	151	442	1,423	260,803
Photostream	71	194	666	135,202
Sets	3	9	86	9,939
Collections	2	3	2	57
	227	648	2,177	406,001

#### Your most viewed photos and videos

Yesterday All time





f	Flickr	26,098	<u>f</u>	Flickr	26,098
3	Google	12,845	G	Google	12,845
	twitter.com	389	t	twitter.com	389
ø	MSN	78	W	MSN	78
10.	virb.com	77	Vina*	virb.com	77
	foo.com	54		foo.com	54
	bar.com	32		bar.com	32
	poop.com	8		poop.com	8
	bar.com	32		bar.com	32
	poop.com	8		poop.com	8

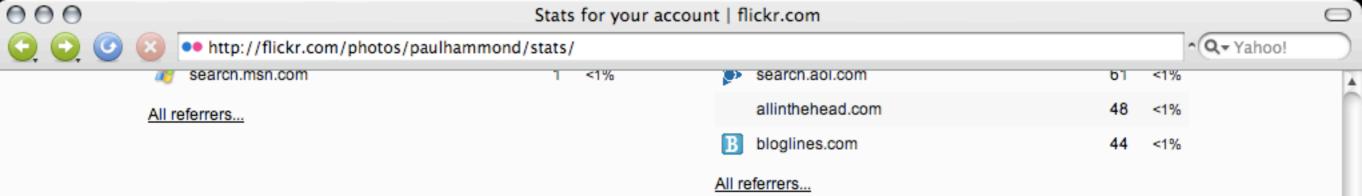
000

Jellyfish

Top referrers today

More...

# "There's only a few million permutations. We can render them all up front"



#### Breakdown of your photos and videos (1,491)

1,221
10
0
10
250
1,484
7

	4.470	
Tagged	1,479	With views
Not tagged	12	Without views
Geotagged	592	With comments
Not geotagged	899	Without comments
In sets	785	Favorited
Not in sets	706	Not favorited
In groups	331	
Not in groups	1,160	

Activity On Your Photostream | Comments You've Made | In Your Groups | From your friends

You Your Photostream | Organize | Upload | Your Account | Do More, Order Prints

Explore Places | Last 7 Days | This Month | Popular Tags | The Commons | Creative Commons | Search

Help Community Guidelines | The Help Forum | FAQ | Tools | Sitemap | Help by Email

Flickr Blog | About Flickr | Terms of Service | Your Privacy | Copyright/IP Policy | Report Abuse

aYAHOO!company

1,483

8

790

701

374

1,117



















Organize - Contacts -

Groups -

Explore -

Signed in as Paul Hammond

Flickr Blog

(387 new) Help Sign Out

Search -

Posted 17 Sep 08



#### Hala Paul Hammond!

Now you know how to greet people in Arabic!

#### » Your Photostream pro

Recent Uploads | Recent Activity



hatrick added you as a contact. View hatrick's profile, contacts, or change your relationship with hatrick.

30 hours ago



fashionista | violet added you as a contact. View fashionista | violet's profile, contacts, or add fashionista | violet as a contact, too.







#### The Sea, the Sea

» Upload Photos & Videos

The National Maritime Museum in Greenwich joins The Commons on Flickr today. Comprised of three separate sites - the Maritime Galleries, the Royal...



warhead said: well, Cal bought a cart.

2 days ago



Making your own posters, books or backup disks is easy.

Capital One: Personalize your



marcin.oleszczyk added you as a contact. View marcin.oleszczyk's profile, contacts, or add marcin.oleszczyk as a contact, too.

5 days ago



Rise Of The September Sun commented on Rev Dan Catt's photo: so cute!!

5 days ago

credit card

Capital One lets you have your favorite photo printed on your credit card!



More recent activity

And even more you can do with your photos:

#### » Your Contacts









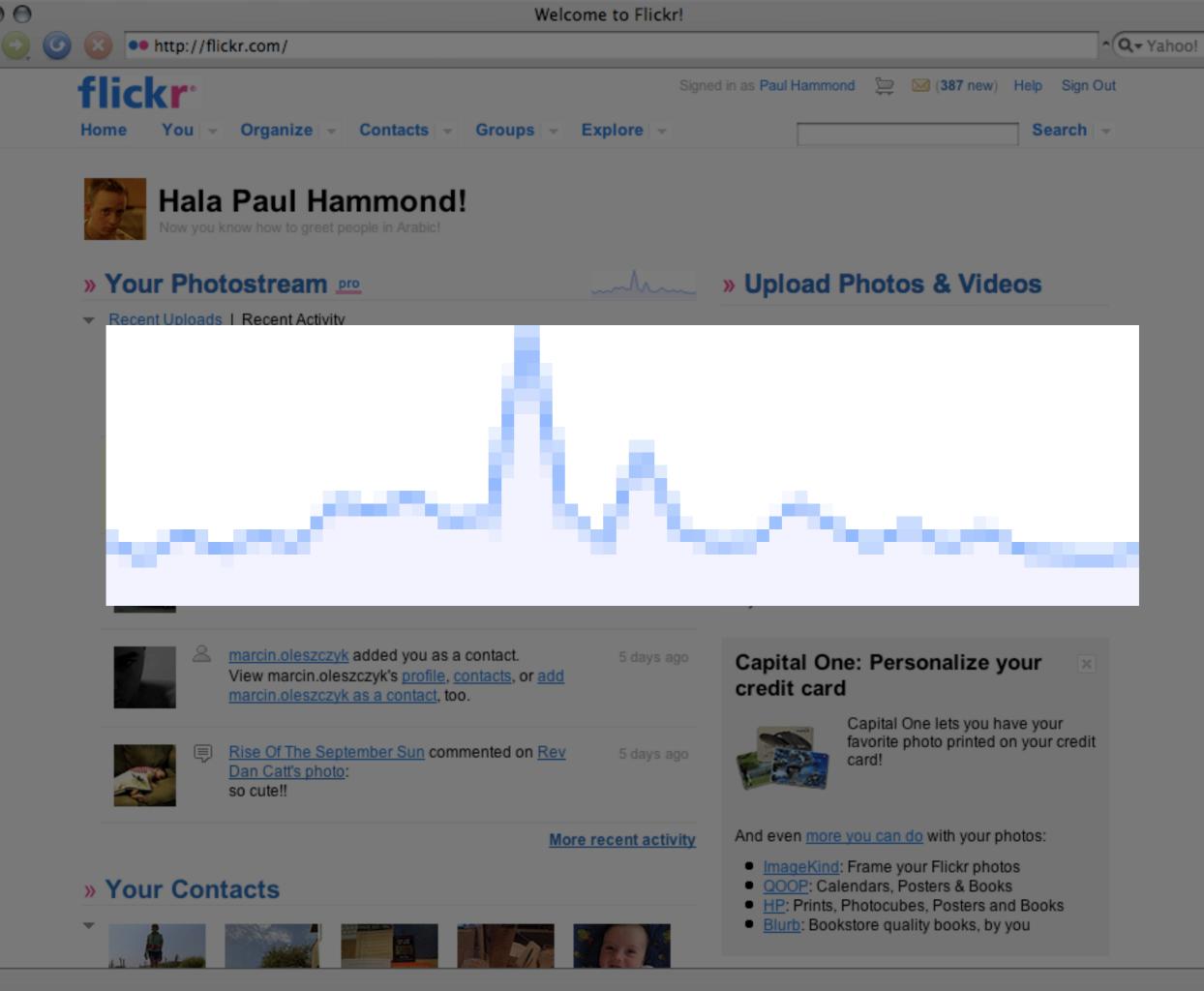


HP: Prints, Photocubes, Posters and Books

Blurb: Bookstore quality books, by you

ImageKind: Frame your Flickr photos

QOOP: Calendars, Posters & Books



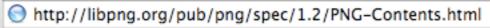
# GD and Imagemagick are slow and take up a lot of memory













#### PNG (Portable Network Graphics) Specification, Version 1.2

For list of authors, see Credits.

#### **Status of this Document**

This is a revision of the PNG 1.0 specification, which has been published as RFC-2083 and as a W3C Recommendation. The revision has been released by the PNG Development Group but has not been approved by any standards body.

The PNG specification is on a standards track under the purview of ISO/IEC JTC 1 SC 24 and is expected to be released eventually as ISO/IEC International Standard 15948. It is the intent of the standards bodies to maintain backward compatibility with this specification. Implementors should periodically check the PNG online resources (see Online Resources) for the current status of PNG documentation.

#### Abstract

This document describes PNG (Portable Network Graphics), an extensible file format for the lossless, portable, well-compressed storage of raster images. PNG provides a patent-free replacement for GIF and can also replace many common uses of TIFF. Indexed-color, grayscale, and truecolor images are supported, plus an optional alpha channel. Sample depths range from 1 to 16 bits.

PNG is designed to work well in online viewing applications, such as the World Wide Web, so it is fully streamable with a progressive display option. PNG is robust, providing both full file integrity checking and simple detection of common transmission errors. Also, PNG can store gamma and chromaticity data for improved color matching on heterogeneous platforms.

This specification defines the Internet Media Type "image/png".

#### Reading this document

If "231" looks like

the number "231" instead of 2 raised to the power 31, your viewer is not recognizing the HTML <SUP> tag that was introduced in HTML version 3.2; you need to look at the HTML 2.0, ASCII text, or PostScript version of this document instead, or use another browser.

#### **Table of Contents**

1. Introduction

# Do we need to generate the graph on the fly? How much interaction? How pretty do you want it to be?

### Details

#### Problem with stats?



ksfoto pro says:

Over the last month my daily views usually were in the range between 50 and 100. Yesterdays stats show only 6 views.

Was that only a bad day or did somebody else also notice unusual stats? Posted at 2:32AM, 5 September 2008 PDT ( permalink )





flickr.com

4

Hello ph [logout]

Search:

Case #:

You are here: > User 5806 > Stats



#### Paul Hammond / Paul Hammond

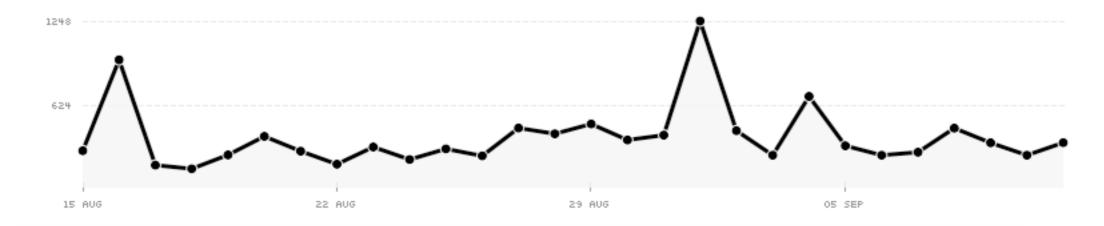
id: 5806 / nsid: 35034345504@N01 / yahoo id: paulhammondorg On Shard 48 [?]

**Data Migration Contacts Data Migration** Auth Reset **Data Consistency** 

Main Info

Stats Shard shard 4. Account has stats Upgraded on Thursday 13 Dec '07, 12.34am UTC Not Locked Has stats from Monday 26 Nov '07, 12.00am UTC (week 48) Known data loss on 3 days

#### Graph data ( Recalculate



#### Nightly Crunch Run Now

Last Automatic Crunch Start: 11 Sep 08, 6.23PM PDT (20 hours ago) Last Crunch Completed: 11 Sep 08, 6.23PM PDT (20 hours ago)

(these 2 numbers should both be in the last 36 hours for all users with stats)

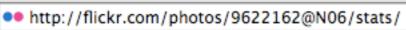
What's the first day of the week?















Organize: -

Contacts -

Groups -

Explore -



Signed in as ph\_testaccount

Search -

(2 new) Help

Sign Out

### Flickr, now with 100% more statistical goodness!

Here's what you'll be able to do...

- Be enthralled by graphs and charts!
- Learn which of your photos are popular today, this week, or over all time
- Discover where your visitors are coming from
- See **how** they found you
- Thrill at a helpful **breakdown** of your photos

#### Want your stats?

#### Yes! Activate me!

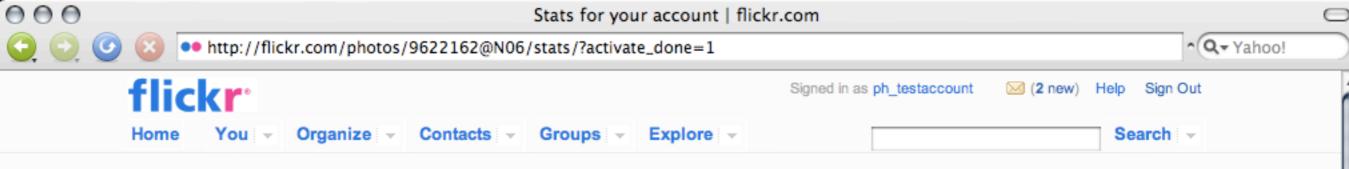
We're only crunching numbers for members who ask, so click the big button if you want in.

#### Account overview



#### Individual photos







Thanks! We will now process your account stats...



It takes a little while to dig up the numbers for your account.

Please check back tomorrow and things should be ready then.

Activity On Your Photostream | Comments You've Made | In Your Groups | From your friends

You Your Photostream | Organize | Upload | Your Account | Do More, Order Prints

Explore Places | Last 7 Days | This Month | Popular Tags | The Commons | Creative Commons | Search

Help Community Guidelines | The Help Forum | FAQ | Tools | Sitemap | Help by Email

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繁體中文 | Deutsch | English | Español | Français | 한글 | Italiano | Português

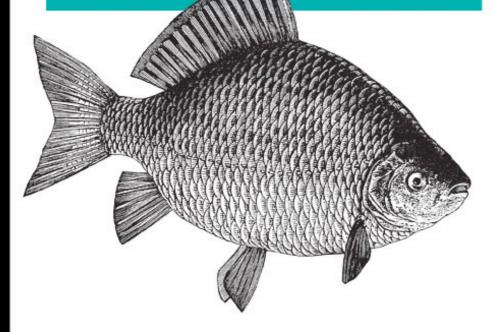
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Offline tasks
Sharding
Database indexes
Summary tables

Building, Scaling, and Optimizing the Next Generation of Web Applications

TO THEK

# Building Scalable Web Sites



O'REILLY®

Cal Henderson

/THEORY/IN/PRACTICE

## Art of Capacity Planning



O'REILLY\*

John Allspaw

# Iterative design & development Product and design solutions to technical problems Hard work Details matter

### Thank you!

### http://www.paulhammond.org/2008/flickrstats

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