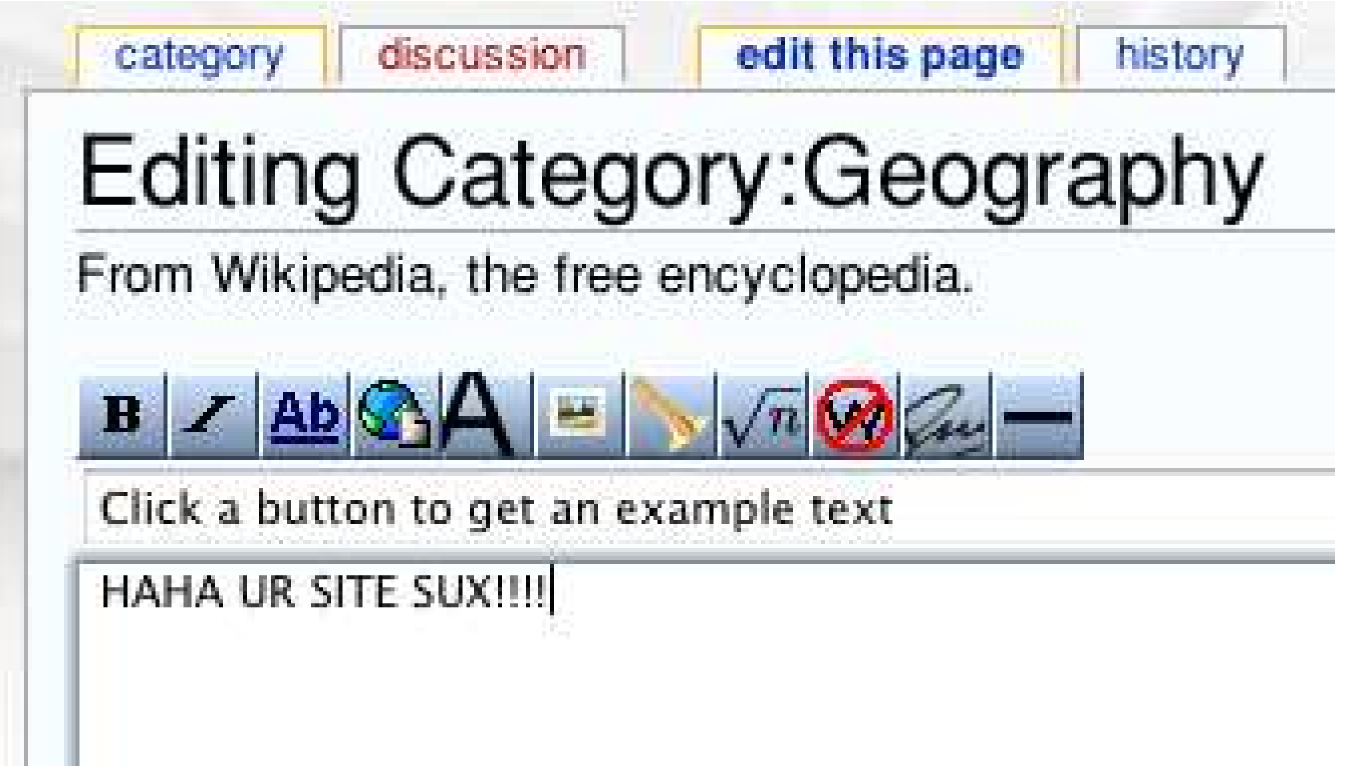
[[Edit This Page]]

Scaling the Wiki beyond 1 Million

21c3 2004-12-27

What's a Wiki?

- Quick!
- Let wackos edit your site
- With luck, good wackos outnumber bad



Editing Category:Geography

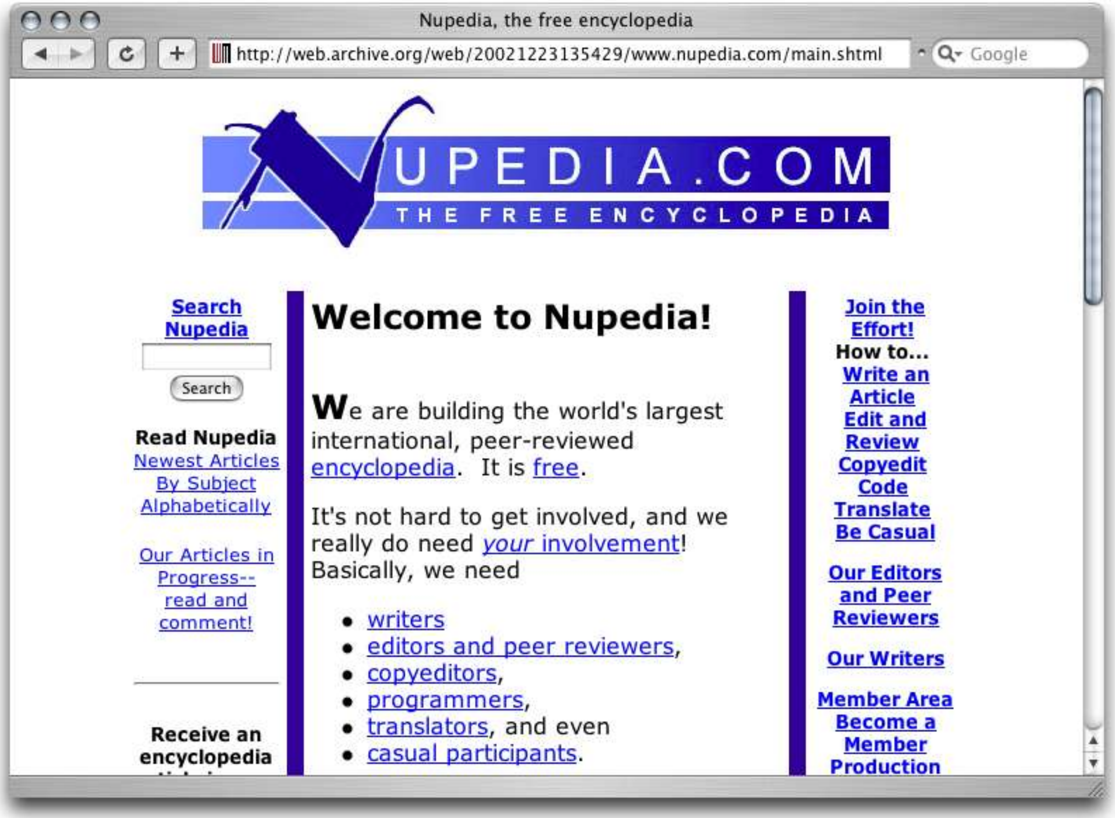
From Wikipedia, the free encyclopedia.

Click a button to get an example text

HAHA UR SITE SUX!!!!

First, there was Nupedia

- Limited contributions
- Slow review process
- ~28 good articles in one year



Welcome to Nupedia!

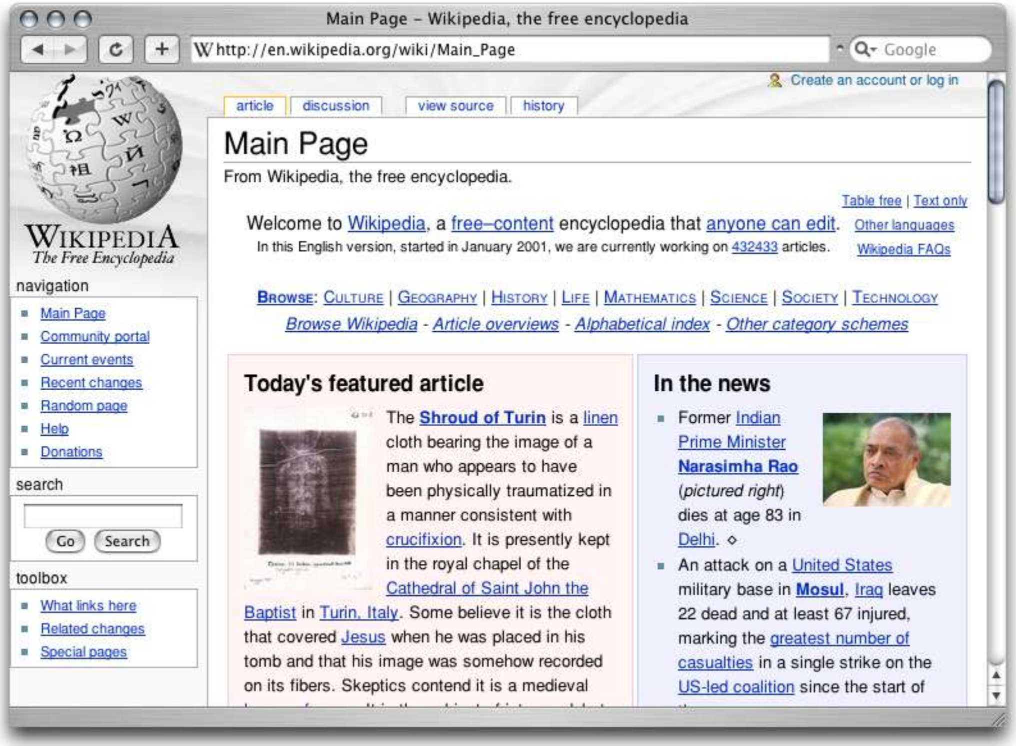
We are building the world's largest international, peer-reviewed encyclopedia. It is free.

It's not hard to get involved, and we really do need *your* involvement! Basically, we need

- writers
- editors and peer reviewers,
- copyeditors,
- programmers,
- translators, and even
- casual participants.

Enter Wikipedia

- Low barriers to participation
- Experimentation encouraged
- Exponential growth



Main Page

From Wikipedia, the free encyclopedia.

Welcome to Wikipedia, a free–content encyclopedia that anyone can edit.
In this English version, started in January 2001, we are currently working on 432433 articles.

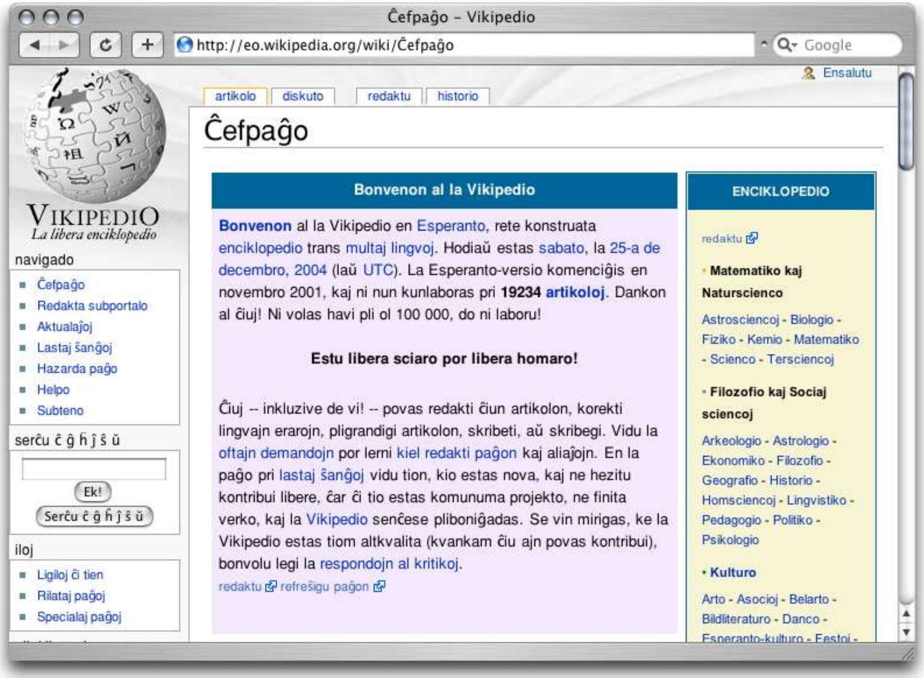
Browse: Culture | Geography | History | Life | Mathematics | Science | Society | Technology
Browse Wikipedia - *Article overviews* - *Alphabetical index* - *Other category schemes*

Today's featured article

The **Shroud of Turin** is a linen cloth bearing the image of a man who appears to have been physically traumatized in a manner consistent with crucifixion. It is presently kept in the royal chapel of the Cathedral of Saint John the Baptist in Turin, Italy. Some believe it is the cloth that covered Jesus when he was placed in his tomb and that his image was somehow recorded on its fibers. Skeptics contend it is a medieval

In the news

- Former Indian Prime Minister **Narasimha Rao** (*pictured right*) dies at age 83 in Delhi. ◇
- An attack on a United States military base in **Mosul**, Iraq leaves 22 dead and at least 67 injured, marking the greatest number of casualties in a single strike on the US-led coalition since the start of



Ĉefpaĝo

Bonvenon al la Vikipedio

Bonvenon al la Vikipedio en Esperanto, rete konstruata enciklopedio trans multaj lingvoj. Hodiaŭ estas sabato, la 25-a de decembro, 2004 (laŭ UTC). La Esperanto-versio komenciĝis en novembro 2001, kaj ni nun kunlaboras pri **19234 artikoloj**. Dankon al ĉiuj! Ni volas havi pli ol 100 000, do ni laboru!

Estu libera sciaro por libera homaro!

Ĉiuj -- inkluzive de vi! -- povas redakti ĉiun artikolon, korekti lingvajn erarojn, pligrandigi artikolon, skribeti, aŭ skribegi. Vidu la oftajn demandojn por lerni kiel redakti paĝon kaj aliaĵojn. En la paĝo pri lastaj ŝanĝoj vidu tion, kio estas nova, kaj ne hezitu kontribui libere, ĉar ĉi tio estas komunuma projekto, ne finita verko, kaj la Vikipedio senĉese pliboniĝadas. Se vin mirigas, ke la Vikipedio estas tiom altkvalita (kvankam ĉiu ajn povas kontribui), bonvolu legi la respondojn al kritikoj.

redaktu refreŝigu paĝon

ENCIKLOPEDIO

redaktu

- **Matematiko kaj Naturscienco**

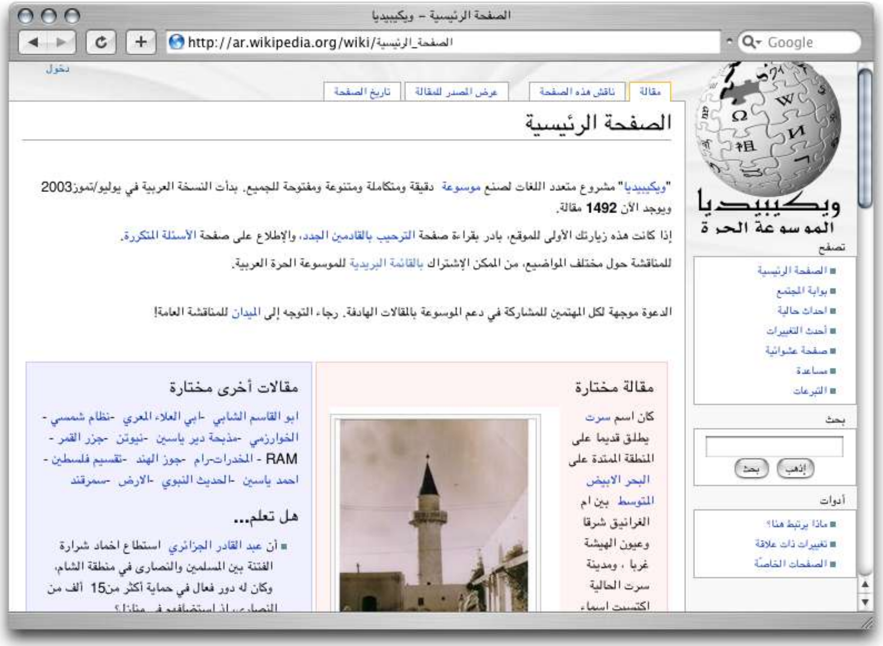
Astrosciencoj - Biologio - Fiziko - Kemio - Matematiko - Scienco - Tersciencoj

- **Filozofio kaj Sociaj sciencoj**

Arkeologio - Astrologio - Ekonomiko - Filozofio - Geografio - Historio - Homsciencoj - Lingvistiko - Pedagogio - Politiko - Psikologio

- **Kulturo**

Arto - Asocioj - Belarto - Bildliteraturo - Danco - Esperanto-kulturo - Festoj -



الصفحة الرئيسية

"ويكيبيديا" مشروع متعدد اللغات لصنع موسوعة دقيقة ومتكاملة ومتنوعة ومفتوحة للجميع. بدأت النسخة العربية في يوليو/تموز2003
ويوجد الآن **1492** مقالة.

إذا كانت هذه زيارتك الأولى للموقع، بادر بقراءة صفحة الترحيب بالقادمين الجدد، والإطلاع على صفحة الأسئلة المتكررة.

للمناقشة حول مختلف المواضيع، من المكن الإشتراك بالقائمة البريدية للموسوعة الحرة العربية.

الدعوة موجهة لكل المهتمين للمشاركة في دعم الموسوعة بالمقالات الهادفة. رجاء التوجه إلى الميدان للمناقشة العامة!

مقالة مختارة

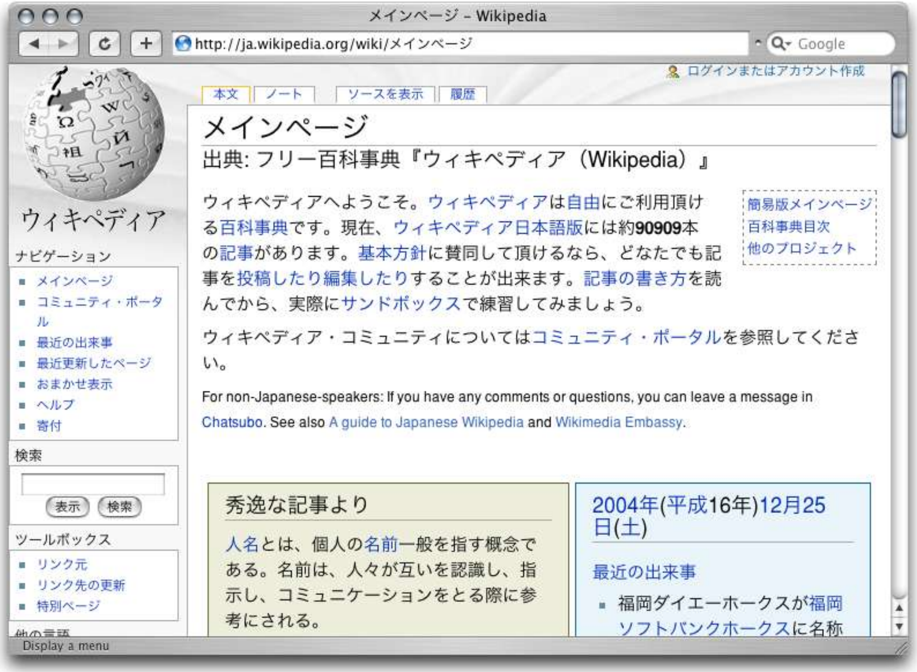
كان اسم سرت يطلق قديما على المنطقة الممتدة على البحر الابيض المتوسط بين ام الغرانيق شرقا وعيون الهيشة غربا ، ومدينة سرت الحالية اكتسبت اسماء

مقالات أخرى مختارة

ابو القاسم الشابي -ابي العلاء المعري -نظام شمسي - الخوارزمي -مذبحة دير ياسين -نيوتن -جزر القمر - RAM - المخدرات-رام -جوز الهند -تقسيم فلسطين - احمد ياسين -الحديث النبوي -الارض -سمرقند

هل تعلم...

- أن عبد القادر الجزائري استطاع اخماد شرارة الفتنة بين المسلمين والنصارى في منطقة الشام، وكان له دور فعال في حماية أكثر من15 ألف من النصارى إذ استضافهم في منازله؟



メインページ

出典: フリー百科事典『ウィキペディア（Wikipedia）』

ウィキペディアへようこそ。ウィキペディアは自由にご利用頂ける百科事典です。現在、ウィキペディア日本語版には約**90909**本の記事があります。基本方針に賛同して頂けるなら、どなたでも記事を投稿したり編集したりすることが出来ます。記事の書き方を読んでから、実際にサンドボックスで練習してみましょう。

簡易版メインページ
百科事典目次
他のプロジェクト

ウィキペディア・コミュニティについてはコミュニティ・ポータルを参照してください。

For non-Japanese-speakers: If you have any comments or questions, you can leave a message in Chatsubo. See also A guide to Japanese Wikipedia and Wikimedia Embassy.

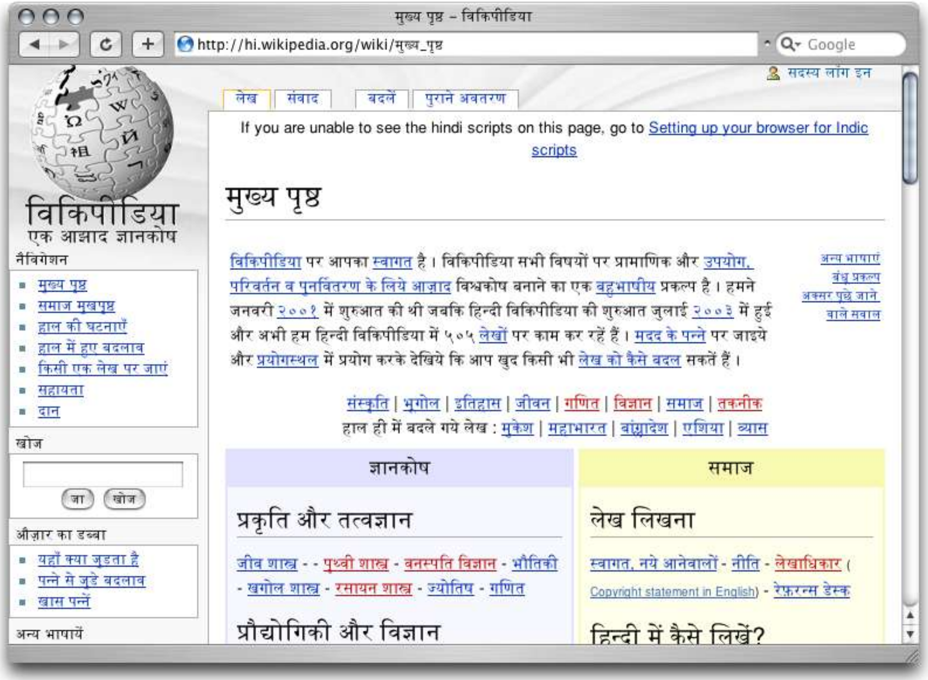
秀逸な記事より

人名とは、個人の名前一般を指す概念である。名前は、人々が互いを認識し、指示し、コミュニケーションをとる際に参考にされる。

2004年(平成16年)12月25日(土)

最近の出来事

- 福岡ダイエーホークスが福岡ソフトバンクホークスに名称



If you are unable to see the hindi scripts on this page, go to Setting up your browser for Indic scripts

मुख्य पृष्ठ

विकिपीडिया पर आपका स्वागत है। विकिपीडिया सभी विषयों पर प्रामाणिक और उपयोग, परिवर्तन व पुनर्वितरण के लिये आज़ाद विश्वकोष बनाने का एक बहुभाषीय प्रकल्प है। हमने जनवरी २००१ में शुरुआत की थी जबकि हिन्दी विकिपीडिया की शुरुआत जुलाई २००३ में हुई और अभी हम हिन्दी विकिपीडिया में ५०५ लेखों पर काम कर रहें हैं। मदद के पन्ने पर जाइये और प्रयोगस्थल में प्रयोग करके देखिये कि आप खुद किसी भी लेख को कैसे बदल सकतें हैं।

अन्य भाषाएं
बंधु प्रकल्प
अक्सर पूछे जाने वाले सवाल

संस्कृति | भूगोल | इतिहास | जीवन | गणित | विज्ञान | समाज | तकनीक
हाल ही में बदले गये लेख : मुकेश | महाभारत | बांग्लादेश | एशिया | व्यास

ज्ञानकोष

प्रकृति और तत्वज्ञान

जीव शास्त्र - - पृथ्वी शास्त्र - बनस्पति विज्ञान - भौतिकी - खगोल शास्त्र - रसायन शास्त्र - ज्योतिष - गणित

प्रौद्योगिकी और विज्ञान

समाज

लेख लिखना

स्वागत, नये आनेवालों - नीति - लेखाधिकार (Copyright statement in English) - रेफ़रन्स डेस्क

हिन्दी में कैसे लिखें?

Who's Who

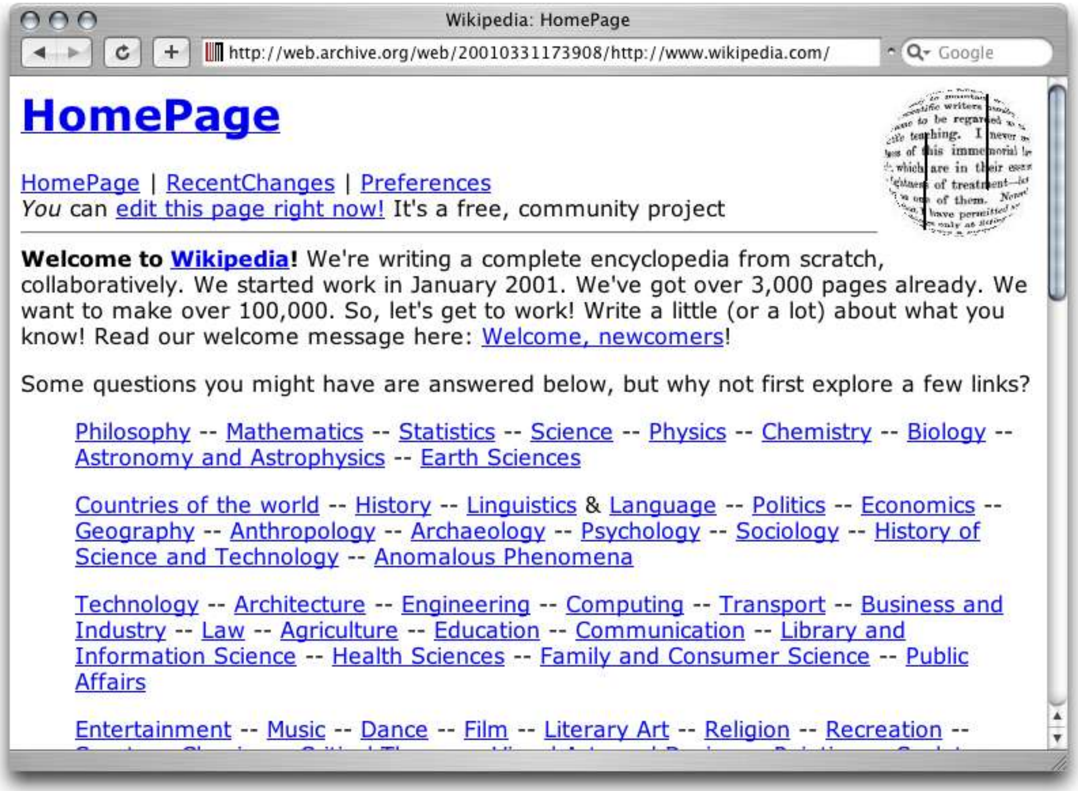
WIKIPEDIA
The Free Encyclopedia

WIKIMEDIA

MediaWiki
Because ideas want to be free.

In the beginning

- UseMod
- Perl-based
- Filesystem storage


Wikipedia: HomePage
http://web.archive.org/web/20010331173908/http://www.wikipedia.com/
Google

HomePage

HomePage | RecentChanges | Preferences
You can edit this page right now! It's a free, community project

Welcome to Wikipedia! We're writing a complete encyclopedia from scratch, collaboratively. We started work in January 2001. We've got over 3,000 pages already. We want to make over 100,000. So, let's get to work! Write a little (or a lot) about what you know! Read our welcome message here: Welcome, newcomers!

Some questions you might have are answered below, but why not first explore a few links?

Philosophy -- Mathematics -- Statistics -- Science -- Physics -- Chemistry -- Biology -- Astronomy and Astrophysics -- Earth Sciences

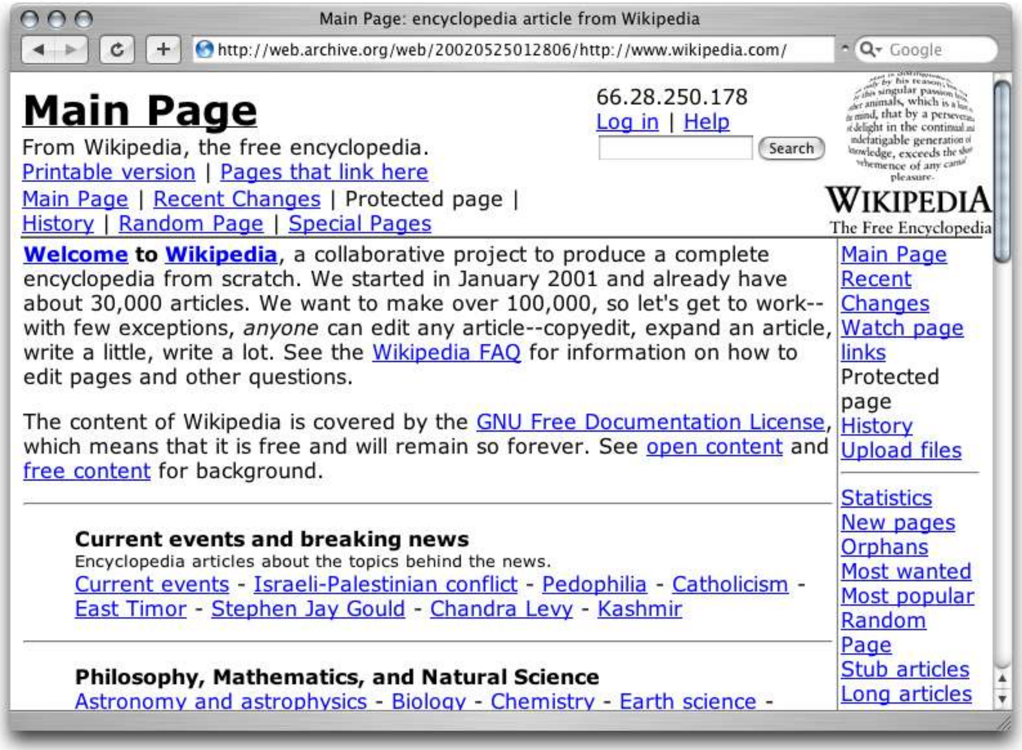
Countries of the world -- History -- Linguistics & Language -- Politics -- Economics -- Geography -- Anthropology -- Archaeology -- Psychology -- Sociology -- History of Science and Technology -- Anomalous Phenomena

Technology -- Architecture -- Engineering -- Computing -- Transport -- Business and Industry -- Law -- Agriculture -- Education -- Communication -- Library and Information Science -- Health Sciences -- Family and Consumer Science -- Public Affairs

Entertainment -- Music -- Dance -- Film -- Literary Art -- Religion -- Recreation --

New backend

- Custom wiki
- PHP-based
- MySQL storage
- Fulltext search
- Ad-hoc queries


Main Page: encyclopedia article from Wikipedia
http://web.archive.org/web/20020525012806/http://www.wikipedia.com/
Google
Search
WIKIPEDIA
The Free Encyclopedia

Main Page

From Wikipedia, the free encyclopedia.
Printable version | Pages that link here
Main Page | Recent Changes | Protected page |
History | Random Page | Special Pages

66.28.250.178
Log in | Help

Welcome to Wikipedia, a collaborative project to produce a complete encyclopedia from scratch. We started in January 2001 and already have about 30,000 articles. We want to make over 100,000, so let's get to work-- with few exceptions, *anyone* can edit any article--copyedit, expand an article, write a little, write a lot. See the Wikipedia FAQ for information on how to edit pages and other questions.

The content of Wikipedia is covered by the GNU Free Documentation License, which means that it is free and will remain so forever. See open content and free content for background.

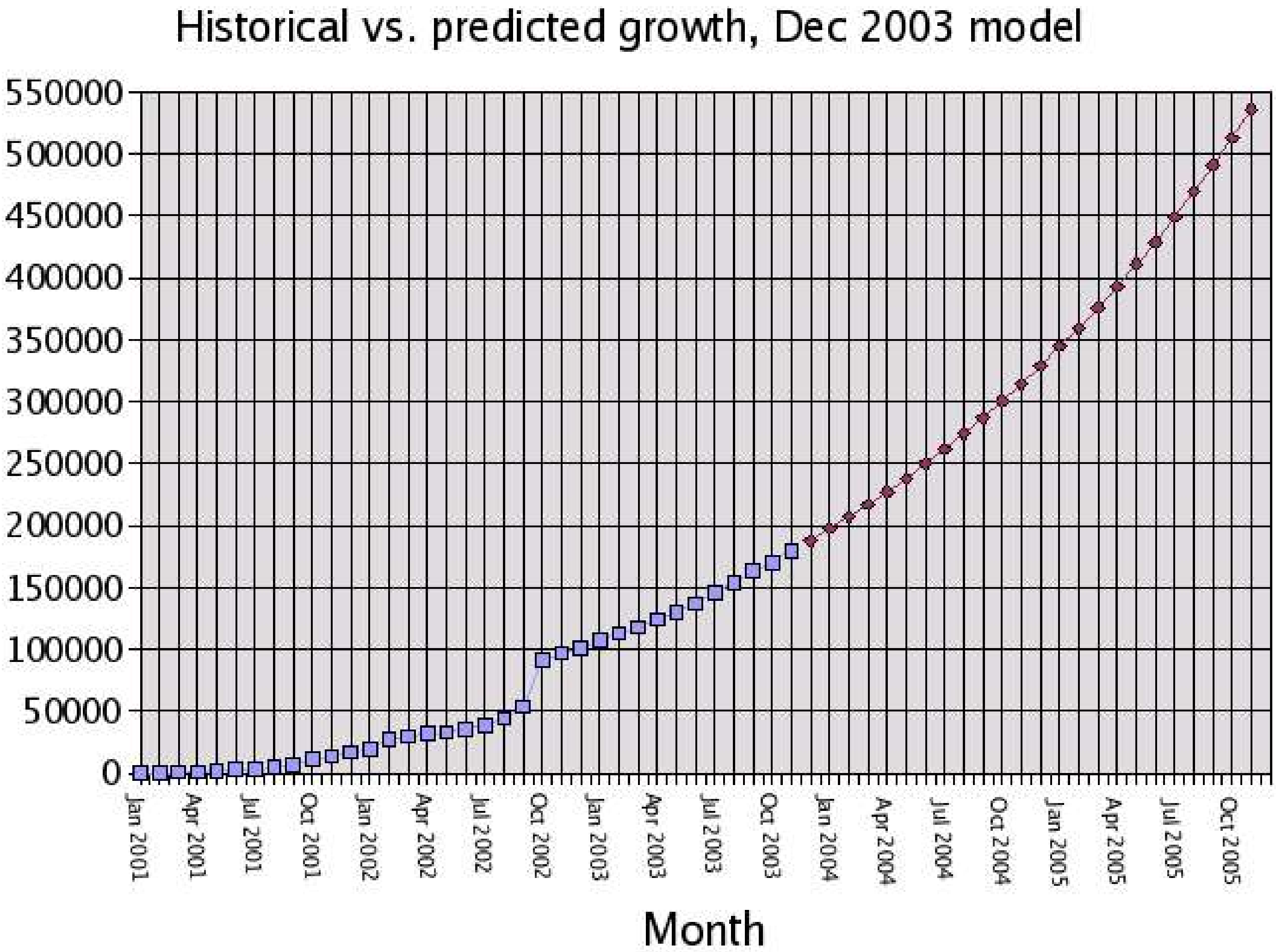
Current events and breaking news
Encyclopedia articles about the topics behind the news.
Current events - Israeli-Palestinian conflict - Pedophilia - Catholicism - East Timor - Stephen Jay Gould - Chandra Levy - Kashmir

Philosophy, Mathematics, and Natural Science
Astronomy and astrophysics - Biology - Chemistry - Earth science -

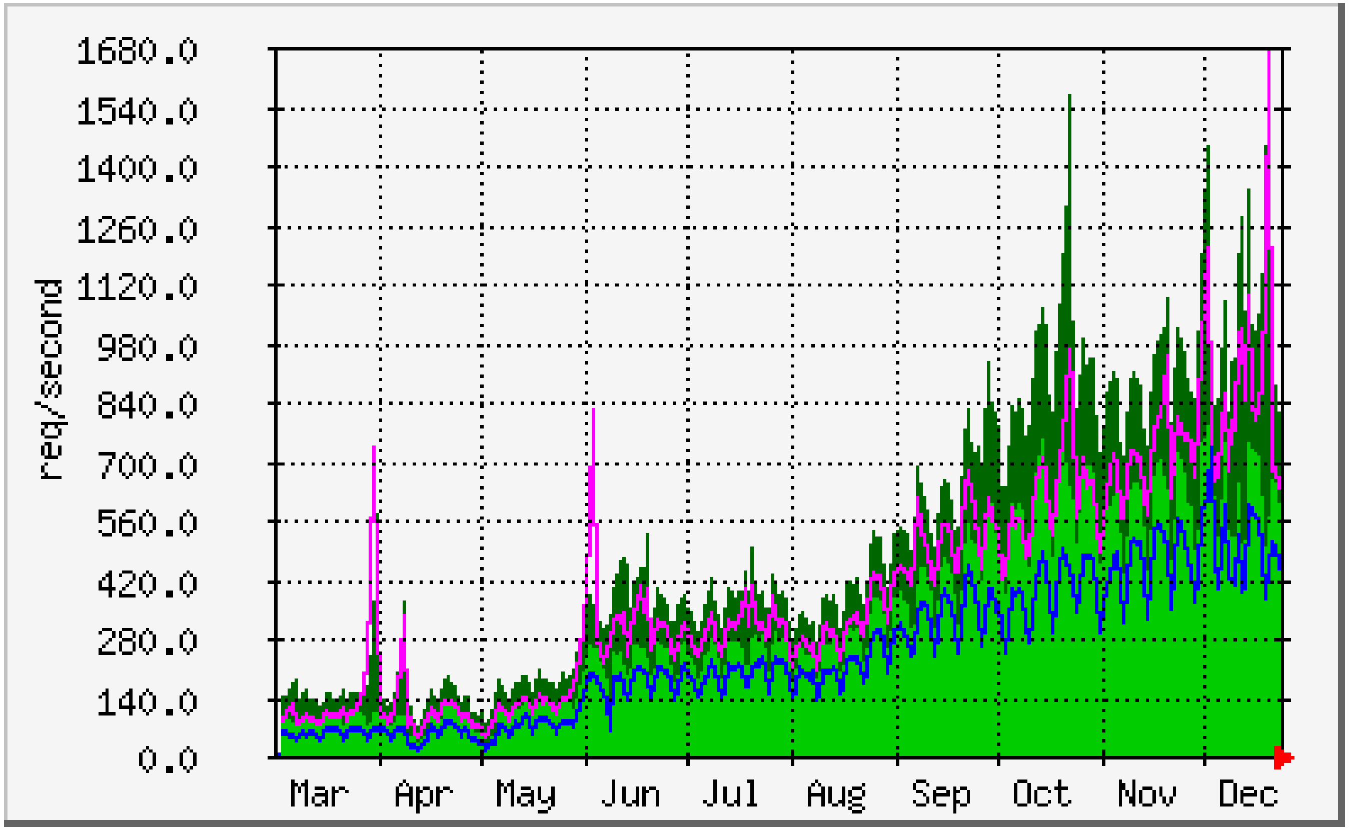
Main Page
Recent Changes
Watch page links
Protected page
History
Upload files

Statistics
New pages
Orphans
Most wanted
Most popular
Random Page
Stub articles
Long articles

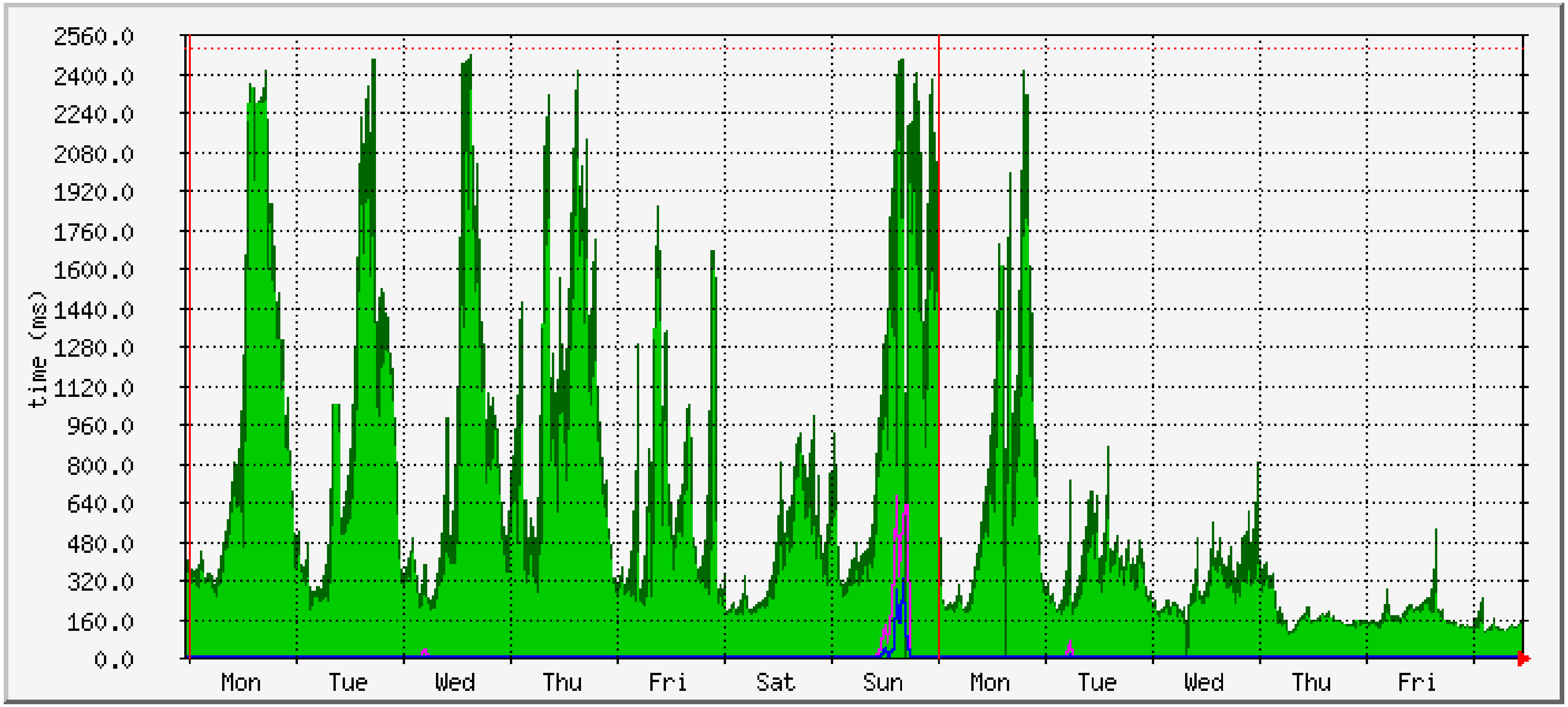
Exponential growth?



Exponential growth!?



High load,
High load times.



Why so difficult?

- Pages may change at any time
- Edits impact other pages
- User options
- User-to-user message notification

- Client must check back
- Output pages per-user

Where to go?

- Do less work
- Do more work at once
- Do work faster

PHP slowwwww

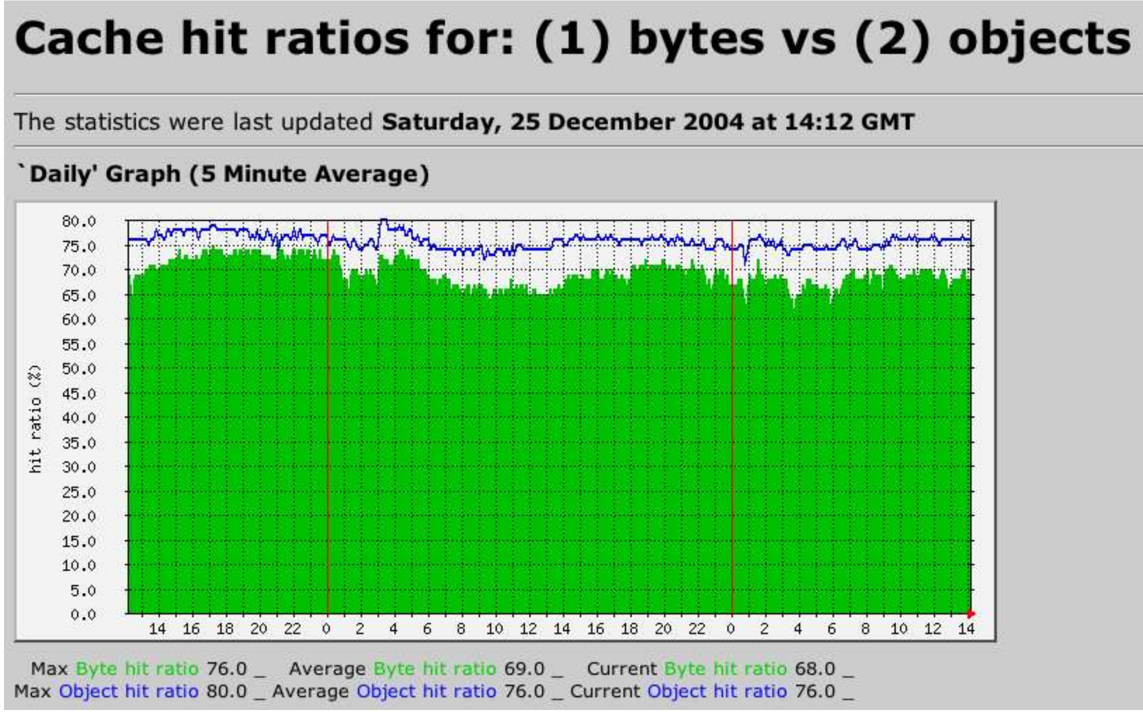
- Stock PHP recompiles source to bytecode on every invocation
- Up to 83% of runtime spent on compilation
- Turck MMCache rumored to cure cancer, remove overhead.

Squid reverse proxy

- Most hits are from anonymous visitors
- Squid serves cached pages faster than PHP ever could

Explicit purge on changes:

Skip the slow PHP code when no change.



Cache hit ratios for: (1) bytes vs (2) objects

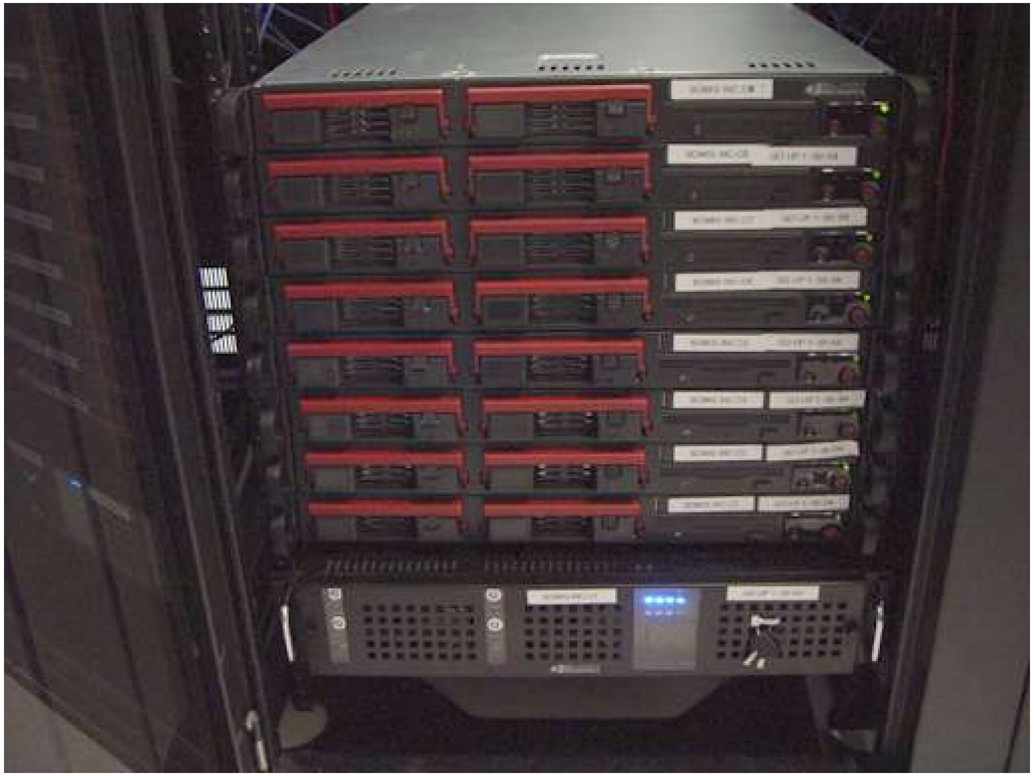
The statistics were last updated **Saturday, 25 December 2004 at 14:12 GMT**

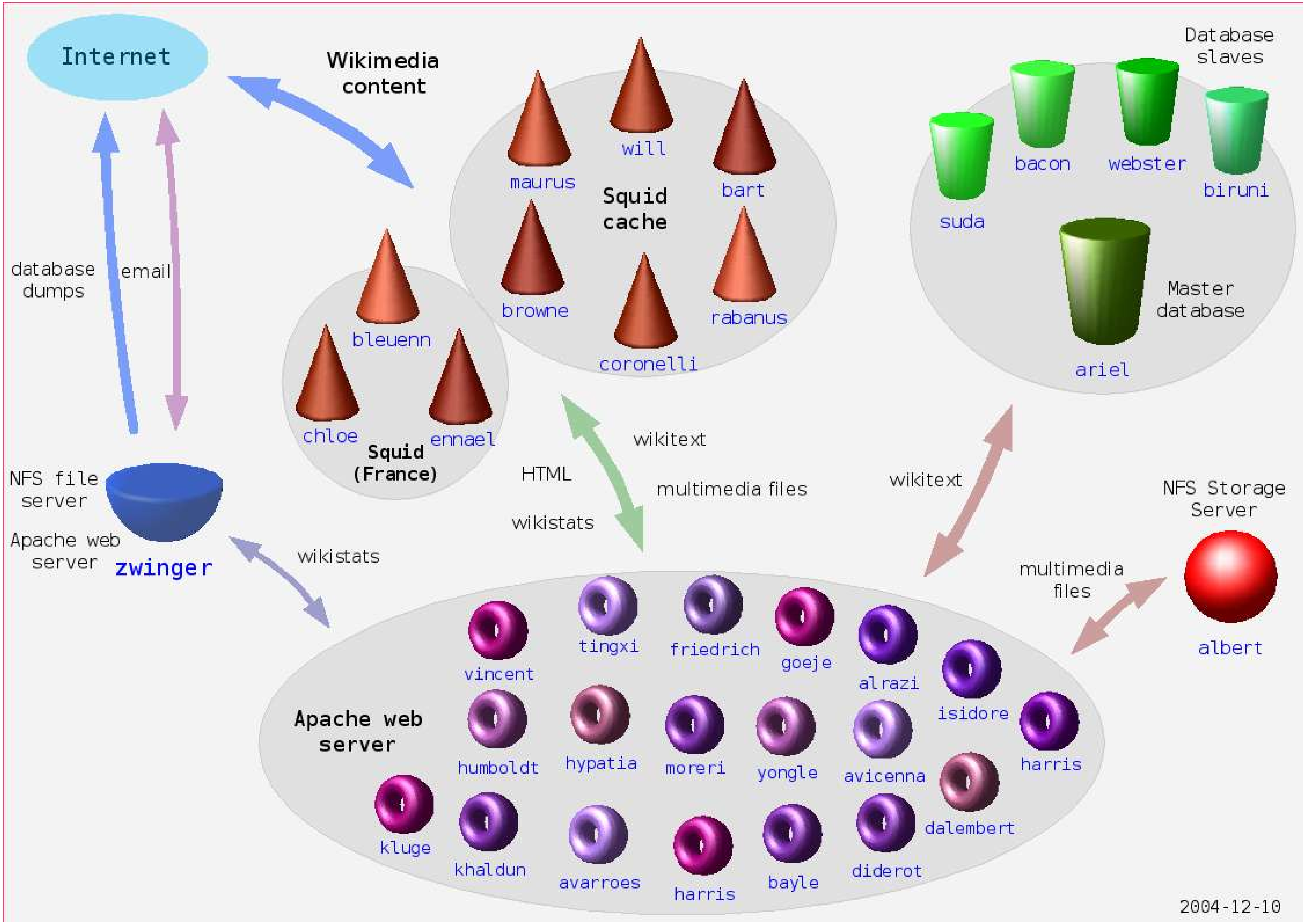
`Daily' Graph (5 Minute Average)

Max Byte hit ratio 76.0 _ Average Byte hit ratio 69.0 _ Current Byte hit ratio 68.0 _
Max Object hit ratio 80.0 _ Average Object hit ratio 76.0 _ Current Object hit ratio 76.0 _

Do more work at once

- Add more servers!
- Costs $$$
- DB bottleneck




Internet
Wikimedia content
Squid cache
maurus
will
bart
browne
coronelli
rabanus
bleuenn
chloe
ennael
Squid (France)
Database slaves
suda
bacon
webster
biruni
Master database
ariel
database dumps
email
NFS file server
Apache web server
zwinger
wikistats
HTML
wikistats
wikitext
multimedia files
wikitext
NFS Storage Server
multimedia files
albert
Apache web server
vincent
tingxi
friedrich
goeje
alrazi
isidore
humboldt
hypatia
moreri
yongle
avicenna
harris
kluge
khaldun
avarroes
harris
bayle
diderot
dalembert
2004-12-10

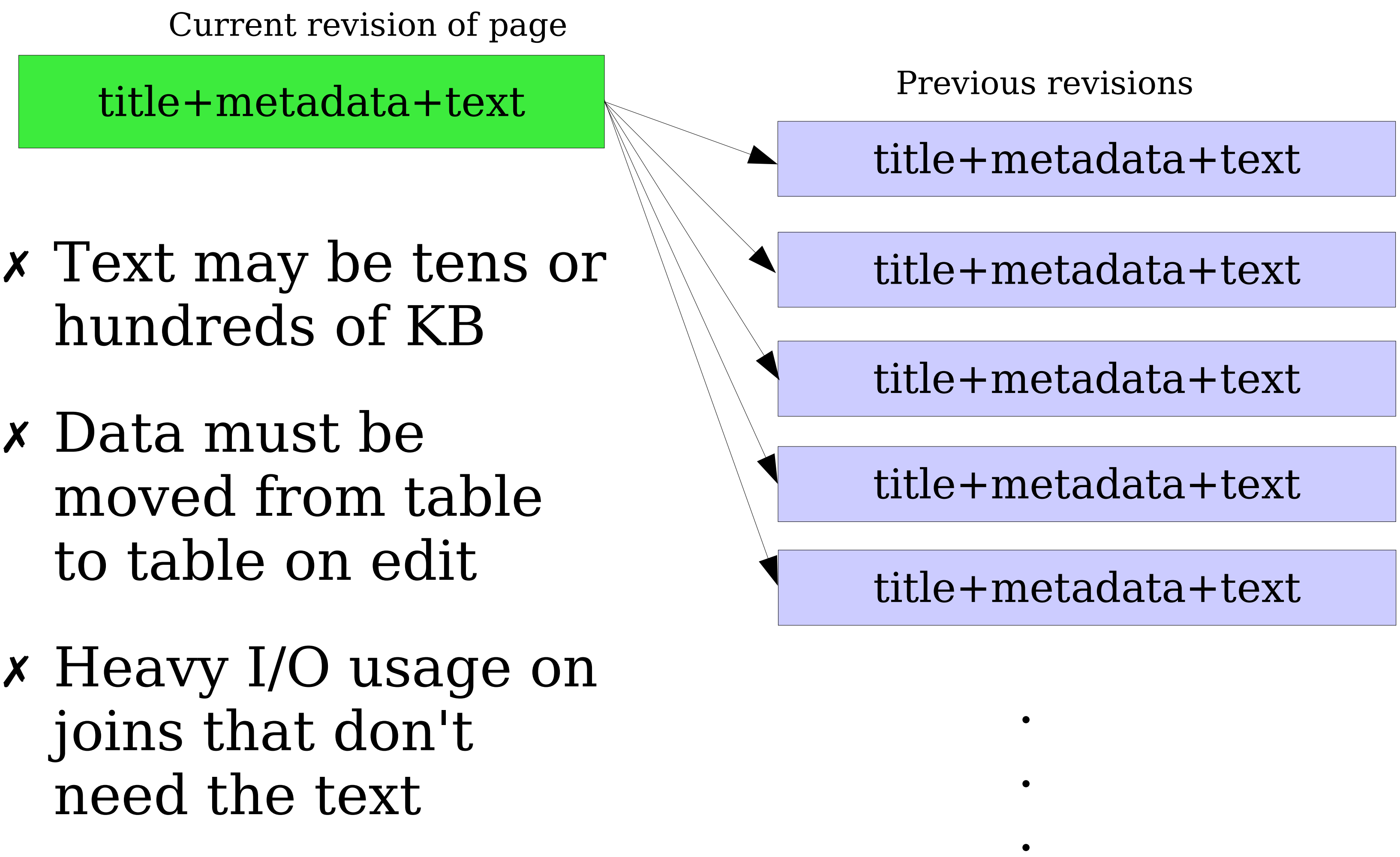
Do work faster

- Pruning code
- Database rearrangement
- Alternate hard and soft layers

Boring optimization

- Move loop invariants
- Avoid redundant text parsing
- Delay initialization of unneeded code
- Increased speed for many operations by up to 100% from 1.3 to 1.4

Database structure



Current revision of page

title+metadata+text

Previous revisions

title+metadata+text

title+metadata+text

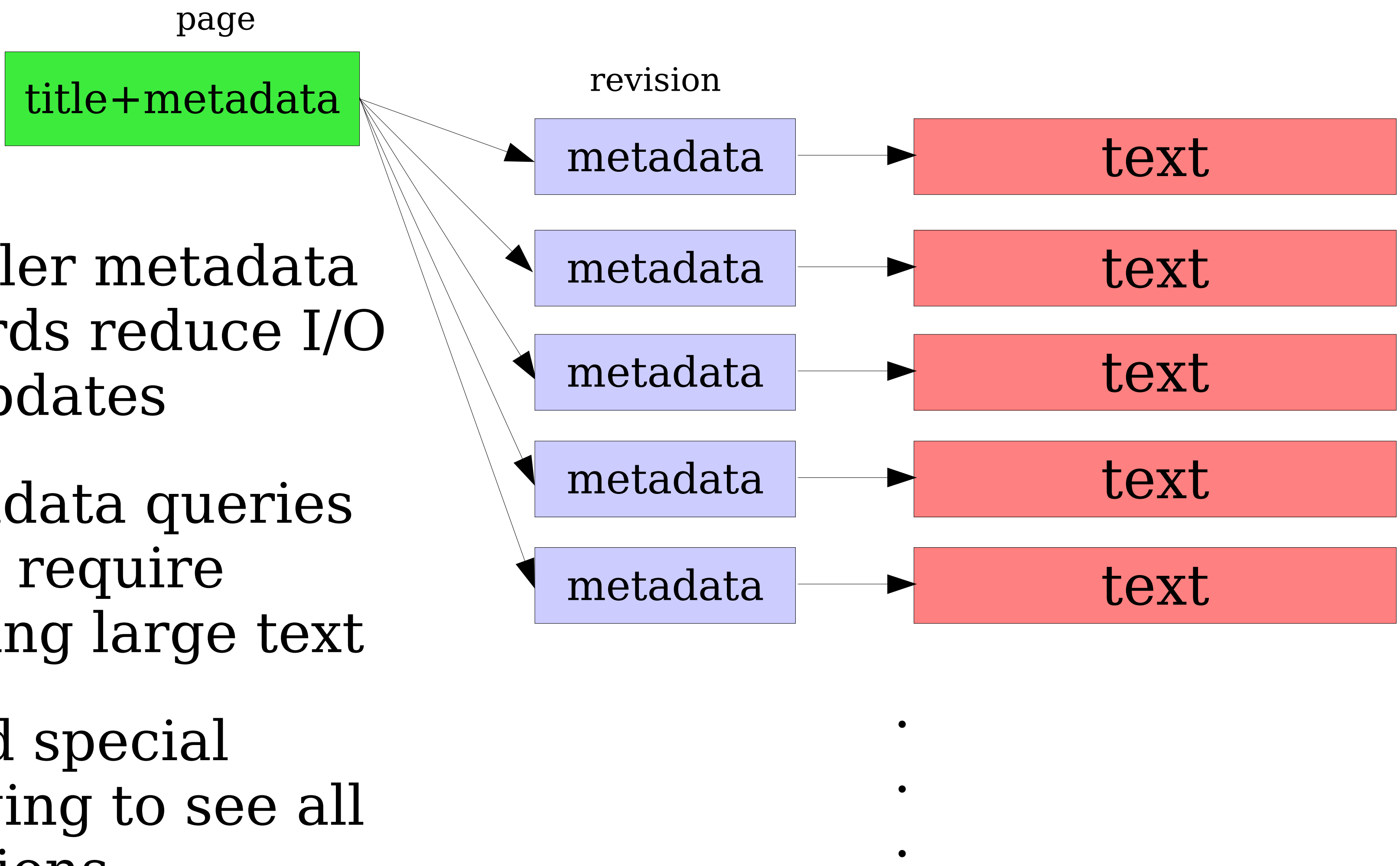
title+metadata+text

title+metadata+text

title+metadata+text

- ✗ Text may be tens or hundreds of KB
- ✗ Data must be moved from table to table on edit
- ✗ Heavy I/O usage on joins that don't need the text
- ✗ Duplication of information causes slow updates

Refactoring



- ✗ Smaller metadata records reduce I/O on updates
- ✗ Metadata queries don't require reading large text
- ✗ Avoid special merging to see all revisions

Alternate hard and soft layers

- PHP – compatibility
- C/C++/Java extensions
  - Subprocess (shell out)
    - LaTeX
  - PHP extensions
    - diff, Unicode
  - Server process sockets/IPC
    - Lucene search

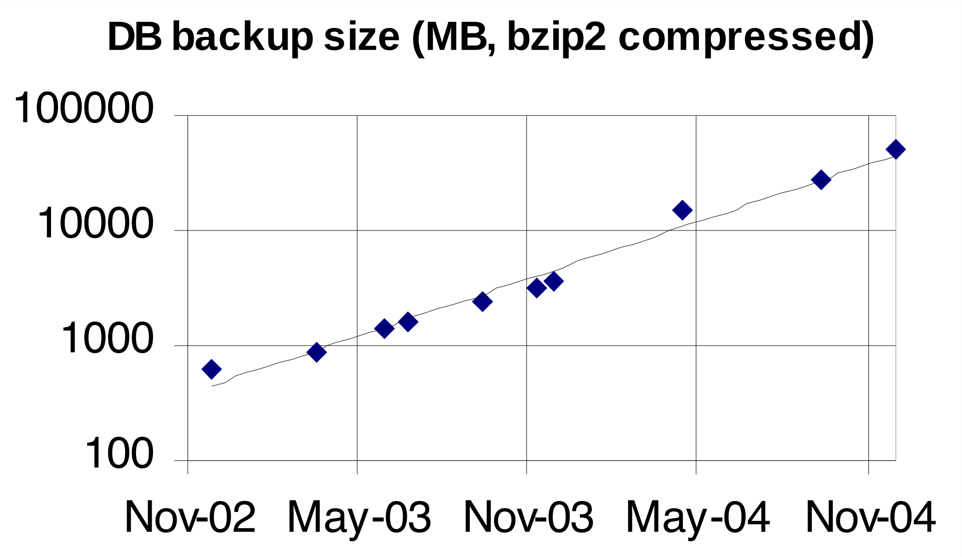
Wikipedia: Edit This Page

Differential Storage

Tim Starling

Wikipedia Growth

- Wikipedia and related projects have been growing at a phenomenal rate
- Database size doubles every 16 weeks



MediaWiki Design

- Based on the principle that hard drive space is cheap
- Minimal development time
- Each revision stored separately
  - Completely uncompressed until January 2004
  - Revisions now compressed with gzip for 50% saving
- Everything stored in MySQL – copy of every revision on every master or slave machine

Hardware Requirements

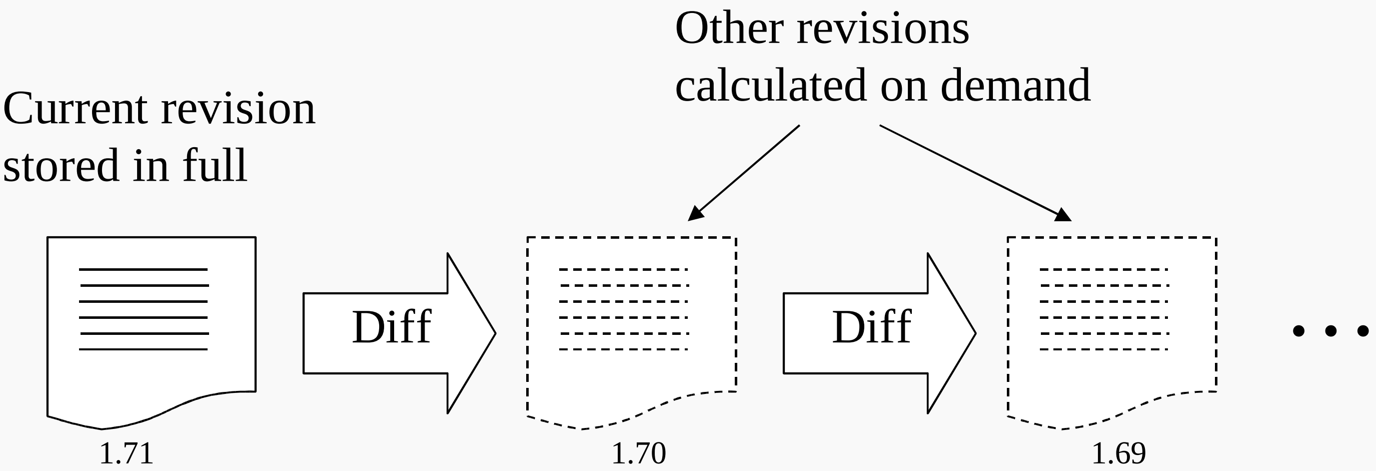
- Master DB server: ariel
- Worth $12,000
- Dual Opteron, 6x73GB 15K SCA SCSI drives: 4 RAID 1+0 (146GB), 2 RAID 1 (72GB)

Effective capacity	200 GB
Database size	171 GB

- No more drive bays available
- Only a week of growth left

Differential Storage

- Why not store diffs, instead of complete revisions?
- Canonical example: RCS

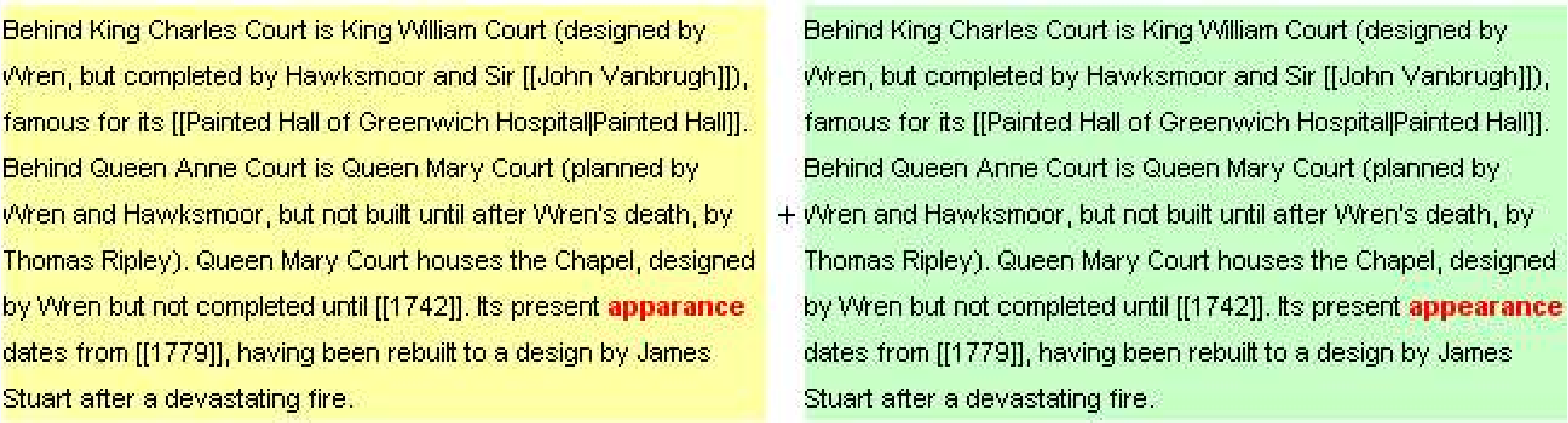


Differential Storage

- RCS:
  - is designed to store code
  - has a simple ASCII data format
- We want the best possible compression ratio
- No need for readability
- Can we do better than RCS?

Wiki Compared to Code

- Wikipedia articles have long lines, many minor changes are made



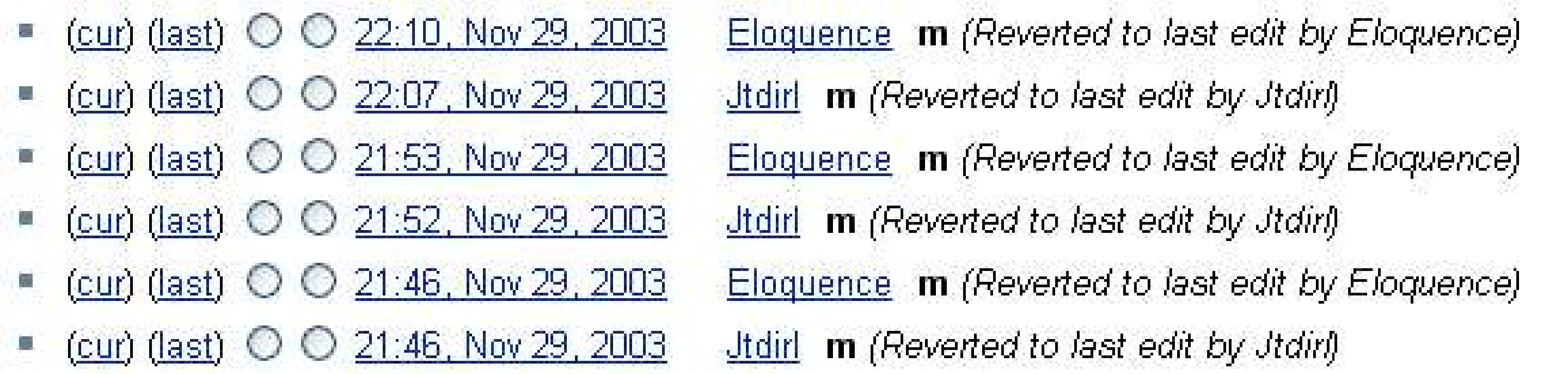
Behind King Charles Court is King William Court (designed by Wren, but completed by Hawksmoor and Sir [[John Vanbrugh]]), famous for its [[Painted Hall of Greenwich Hospital|Painted Hall]]. Behind Queen Anne Court is Queen Mary Court (planned by Wren and Hawksmoor, but not built until after Wren's death, by Thomas Ripley). Queen Mary Court houses the Chapel, designed by Wren but not completed until [[1742]]. Its present **apparance** dates from [[1779]], having been rebuilt to a design by James Stuart after a devastating fire.

+ Behind King Charles Court is King William Court (designed by Wren, but completed by Hawksmoor and Sir [[John Vanbrugh]]), famous for its [[Painted Hall of Greenwich Hospital|Painted Hall]]. Behind Queen Anne Court is Queen Mary Court (planned by Wren and Hawksmoor, but not built until after Wren's death, by Thomas Ripley). Queen Mary Court houses the Chapel, designed by Wren but not completed until [[1742]]. Its present **appearance** dates from [[1779]], having been rebuilt to a design by James Stuart after a devastating fire.

⇒Better if we don’t have to duplicate the whole line

Wiki Compared to Code

- Some articles have lengthy “edit wars”, where the article alternates between two significantly different versions.



- (cur) (last) ○ ○ 22:10, Nov 29, 2003 Eloquence **m** *(Reverted to last edit by Eloquence)*
- (cur) (last) ○ ○ 22:07, Nov 29, 2003 Jtdirl **m** *(Reverted to last edit by Jtdirl)*
- (cur) (last) ○ ○ 21:53, Nov 29, 2003 Eloquence **m** *(Reverted to last edit by Eloquence)*
- (cur) (last) ○ ○ 21:52, Nov 29, 2003 Jtdirl **m** *(Reverted to last edit by Jtdirl)*
- (cur) (last) ○ ○ 21:46, Nov 29, 2003 Eloquence **m** *(Reverted to last edit by Eloquence)*
- (cur) (last) ○ ○ 21:46, Nov 29, 2003 Jtdirl **m** *(Reverted to last edit by Jtdirl)*

- Can we store this efficiently?

Efficient Differential Storage

- What if someone moves a paragraph from one location to another? An ordinary diff won’t store that efficiently.

```
12,13d11
< [[Image:AndalusQuran.JPG|thumb|right|280px|[[12th
century]] [[Andalusia]]n Qur'an]]
<
17a16,17
> [[Image:AndalusQuran.JPG|thumb|right|280px|[[12th
century]] [[Andalusia]]n Qur'an]]
>
```

The LZ Connection

- What we need is an algorithm which will recognise arbitrary sequences of bytes in one revision which are repeated in another revision, and then encode them such that we only store the sequence once.
- This just happens to be what compression algorithms such as LZ77 do.

New Storage Scheme

- Concatenate a number of consecutive revisions
- Compress the resulting “chunk”
- A good compression algorithm will take advantage of the similarity between revisions, and achieve very high compression ratios

Proof of Principle

- We compressed history of three articles:
  - [[Atheism]], an article with lots of edit wars
  - [[Wikipedia:Cleanup]], a discussion page which is incrementally expanded
  - [[Physics]], a typical article with a long revision history
- Because all these articles have a very long revision history, we would expect better than average compression ratios

Proof of Principle

Size of the compressed text compared to the original text:

	gzip	bzip2	diff
Atheism	2.5%	2.3%	15.5%
Cleanup	2.5%	2.5%	1.1%
Physics	2.2%	2.4%	6.9%

- As expected, diffs performed poorly in the edit war case, but very well for incremental addition of text
- Compression methods always performed well

Gzip, Bzip2 and Diff

- Other tests showed bzip2 to give better compression than gzip, but at a much slower speed
- Ratio for diff could have been improved by choosing the most similar revision to take a diff against
- Diff much faster than gzip or bzip2
- Diff-based compression is harder to implement

Implementation

- We implemented a gzip method in MediaWiki 1.4
- Compression is taking place as I speak
- Expected effects:
  - Better utilisation of kernel cache
  - Higher I/O bandwidth for uncached revisions
  - Smaller DB size
- Average compressed size: ~15% of original
- Higher than the tests because the tests used articles with many revisions

Future Directions

- More detailed evaluation of diff-based methods
- Other ways to solve the space problem:
  - Application-level splitting across distinct MySQL instances
  - Distributed filesystems, e.g. GFS