AltaVista

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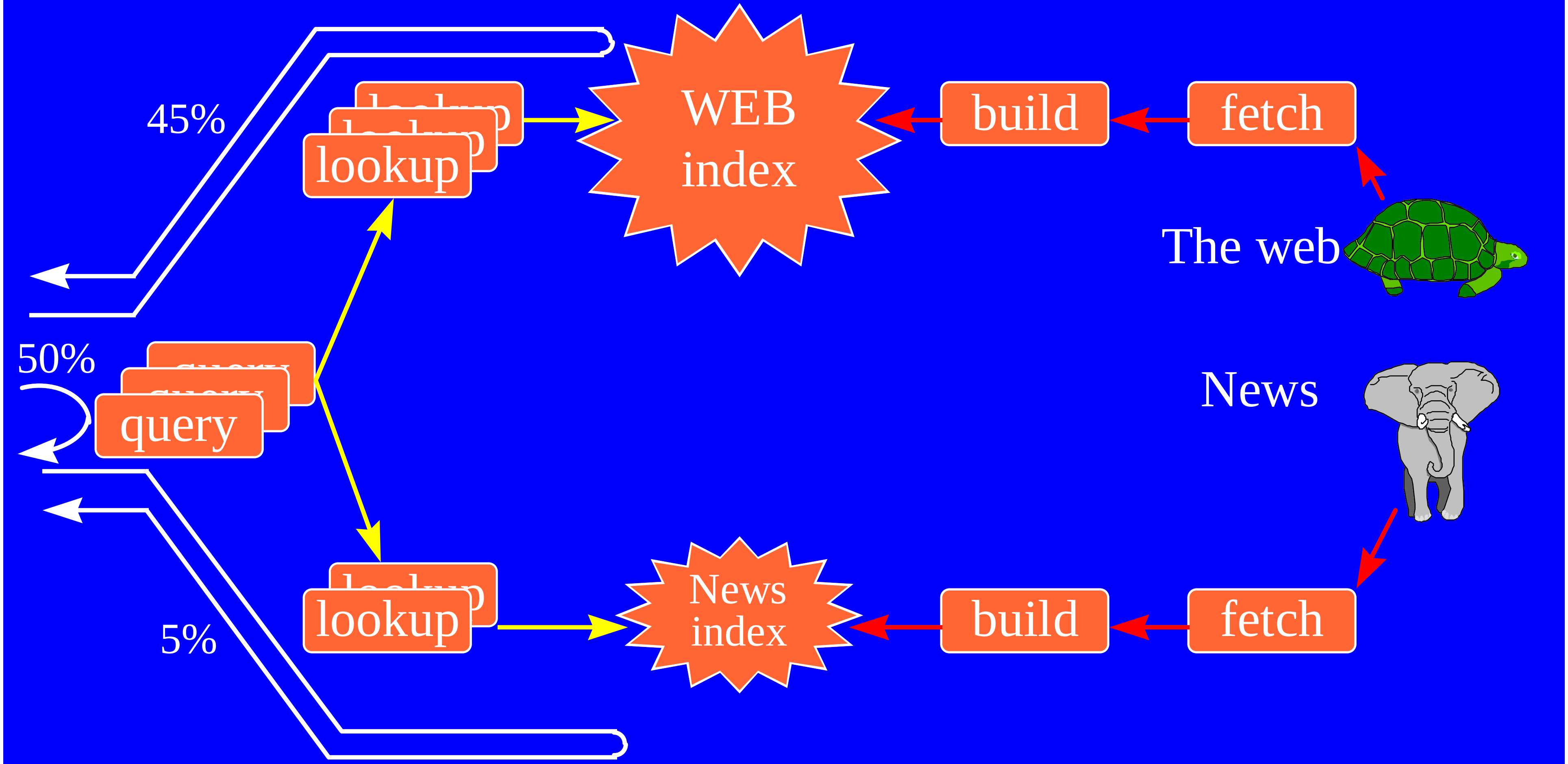
Acknowledgment

AltaVista was created by Mike Burrows and Louis Monier, with the help of many other people.

AltaVista Outline



AltaVista Outline

- Fetch web pages (Scooter)
- Build web index
- The index itself
- Lookup in web index
- Queries from the Internet
- News groups fetch/build/index/lookup
- Statistics
- Conclusions

Fetch Web Pages (Scooter)

- Starting with some URL, fetch that page
- Respect robot exclusion standard
- Deliver page to index builder
- Find all contained URLs
- Add to list of URLs to be fetched
- Do not allow duplicates on the list
- Do not visit the same site very often
- Take first unfetched on list URL and loop

Fetch: original *source* HTML

```
Those... <a href="news:alt.folklore.urban">urban legends</a>. ...
original <a href="whalestory.html">e-mail</a>, ...
<center><img src="line.gif"></center>
<br>... there is the <a
href="http://alpha.mic.dundee.ac.uk/ft/july/whale2.avi">
full news report</a>, ...
<br>... Quicktime ... <a
href="ftp://ftp.xmission.com/pub/users/g/grue/whale.qt">on this link</a>.
... There have been <IMG
SRC="http://www-hons-cs.dcs.st-and.ac.uk/cgi-bin/nph-count?width=6&link=www.st-and.ac.uk/~www_sa/personal/fs1/whale.html"> visitors here ...
```

Fetch: what Scooter *sees*

http://www.st-and.ac.uk/~www_sa/personal/fs1/whale.html

```
Those... <a href="news:alt.folklore.urban">urban legends</a>. ...
original <a href="whalestory.html">e-mail</a>, ...
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href="ftp://ftp.xmission.com/pub/users/g/grue/whale.qt">on this link</a>.
... There have been <IMG
SRC="http://www-hons-cs.dcs.st-and.ac.uk/cgi-bin/nph-
    count?width=6&link=www.st-
    and.ac.uk/~www_sa/personal/fs1/whale.html"> visitors here ...
```

Fetch: what Scooter *does*

http://www.st-and.ac.uk/~www_sa/personal/fs1/whale.html

news: alt.folklore.urban	ignore
whalestory.html	ADD
line.gif	ignore
http://alpha.mic.dundee.ac.uk/ft/july/whale2.avi	ignore
ftp://ftp.xmission.com/pub/users/g/grue/whale.qt	ignore
http://www-hons-cs.dcs.st-and.ac.uk/cgi-bin/nph-count?width=6&link=www.st-and.ac.uk/~www_sa/personal/fs1/whale.html	ignore

Fetch: details

- Scooter only indexes files ending in
  - .html, .htm, .text, .txt
- Only indexes files with
  - no more than 8 levels of directory
- If it takes time _t_ to fetch a page, wait _100*t_ to fetch again from same site
  - guarantees less than 1% load on any site
- Details will be refined over time

Fetch: details

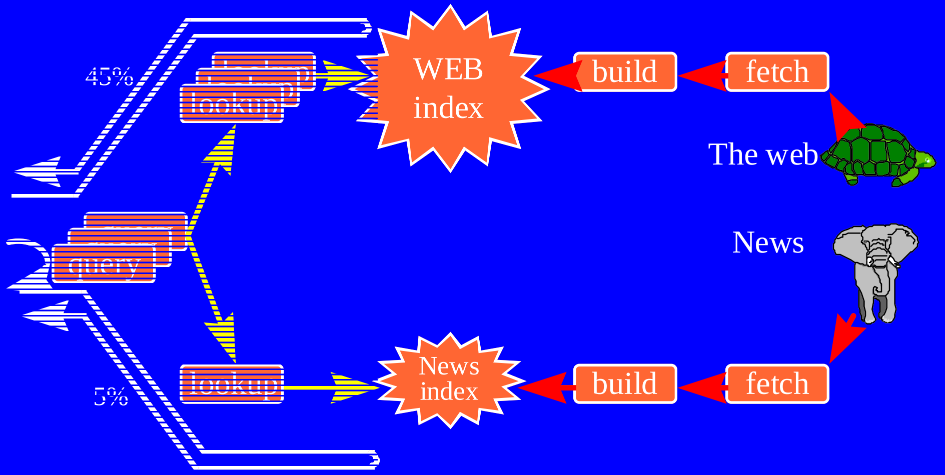
- URL duplicate lookup:
  - 50M URLs at 50 characters each = 2.5GB
  - Too big to keep in memory on small machine
  - 64-bit URL signature used instead
  - Partitioned so average 6 bytes each = 300 MB
  - If new URL signature matches existing one, don’t add to URL list

Fetch: details

- Scooter runs with about 800 threads
- Each is fetching a page from somewhere in the world
- It takes about 5 days to build a full index from scratch

Build Web Index

- Fetch passes each page to index builder



Build: original *source* file

```
<html>
<head><title>How to deal with a beached whale</title></head>
<META Name="description" Content="The fabulous story of The Exploding
Whale in full colour detail. There are pictures and video to explore.">

<H3>The Story of the<H3><BR>
<h1><i>Exploding Whale</i></h1>
  ...
<img src="whale.gif" width=200 height=152 hspace=40 align=right><p>
<br>It was a big whale.
<br><br>It was a smelly whale.
<br><br>Most importantly, it was a dead whale.

</html>
```

Build: AltaVista sees *just words*

ORIGINAL:

```
<html>
<head><title>How to deal with a beached whale</title></head>
<META Name="description" Content="The fabulous story of The Exploding
Whale in full colour detail. There are pictures and video to explore.">
```

ALTAVISTA SEES:

```
<html>
<head><title>How to deal with a beached whale</title></head>
<META Name="description" Content="The fabulous story of The Exploding
      Whale in full colour detail. There are pictures and video to explore.">
```

Build: *just words*

ORIGINAL:

```
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<h1><i>Exploding Whale</i></h1>
<img src="whale.gif" width=200 height=152 hspace=40 align=right><p>
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ALTAVISTA SEES:

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<img src="whale.gif" width=200 height=152 hspace=40 align=right><p>
<br>It was a big whale.
<br><br>It was a smelly whale.
<br><br>Most importantly, it was a dead whale.
```

Build: *case & accents*

Voilà	**le**	**Printemps**
Voila		**printemps**
voilà		
voila		

Index original word, original without accents, without uppercase, and without either

Build: sees *all* these words

```
<H3>The   Story   of   the<H3><BR>
    the   story

<h1><i>Exploding   Whale</i></h1>
       exploding   whale

<img src="whale.   gif" width=200 height=152 hspace=40 align=right><p>

<br>It   was   a   big   whale
    it

<br><br>It   was   a   smelly   whale.
        it

<br><br>Most   importantly,   it   was   a   dead   whale. ♣
        most
```

Build: *numbers* the words

```
<H3>The    Story    of    the<H3><BR>
    the    story
     1       2       3     4

<h1><i>Exploding    Whale</i></h1>
       exploding    whale
           5           6

<img src="whale.   gif" width=200 height=152 hspace=40 align=right><p>
           24       25

<br>It   was   a   big   whale
    it
    7     8    9   10     11

<br><br>It   was   a   smelly   whale.
        it
        12   13    14    15       16

<br><br>Most   importantly,   it   was   a   dead   whale.   ♣
        most
         17         18        19   20   21    22     23     26
```

Build: *list where each word is*

```
<H3>The   Story   of   the<H3><BR>
    the   story
     1      2      3     4
<h1><i>Exploding   Whale</i></h1>
       exploding   whale
           5          6
<img src="whale.   gif" width=200 height=152 hspace=40 align=right><p>
            24      25
<br>It   was   a   big   whale
    it
    7     8    9   10     11
<br><br>It   was   a   smelly   whale.
        it
        12   13   14    15       16
<br><br>Most   importantly,   it   was   a   dead   whale. ♣
        most
         17         18        19   20   21    22     23    26
```

The 1

Build: *the word index*

```
<H3>The   Story   of   the</H3><BR>
    the   story
     1      2      3    4
<h1><i>Exploding   Whale</i></h1>
       exploding   whale
           5          6
<img src="whale.gif" width=200 height=152 hspace=40 align=right><p>
          24     25
<br>It   was   a   big   whale
    it
    7     8    9   10     11
<br><br>It   was   a   smelly   whale.
        it
        12   13    14    15      16
<br><br>Most   importantly,   it   was   a   dead   whale.♣
        most
         17       18          19   20   21    22     23   26
```

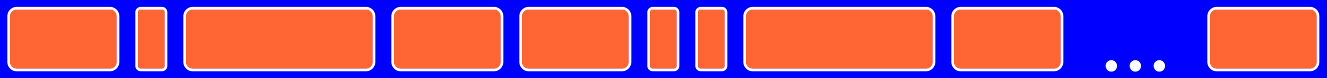
The	1
the	1 4
…	
♣	26

Build: one web page, word index

a	9 14 21
big	10
dead	22
exploding	5
Exploding	5
gif	25
importantly	18
it	7 12 19
It	7 12
most	17
Most	17
of	3
smelly	15
story	2
Story	2
the	1 4
The	1
was	8 13 20
whale	6 11 16 23 24
Whale	6
♣	26

Build: *the full index*

Imagine placing 30M web pages end-to-end as 13 billion words, then building a full word index:



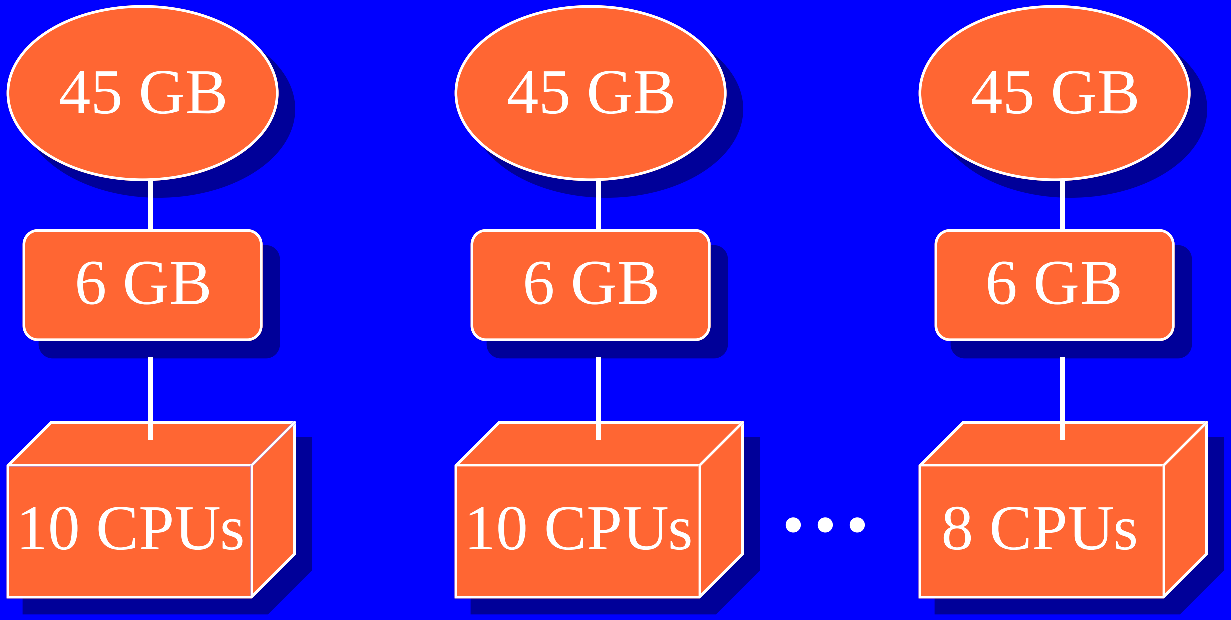
1 [word number] 13,000,000,000

a	9 14 21 345 7012 7122 400123 ...
the	1 4 35 ... 12999888777
zzz	2444888 ...
999	...
♣	26 258 860 1792 ...

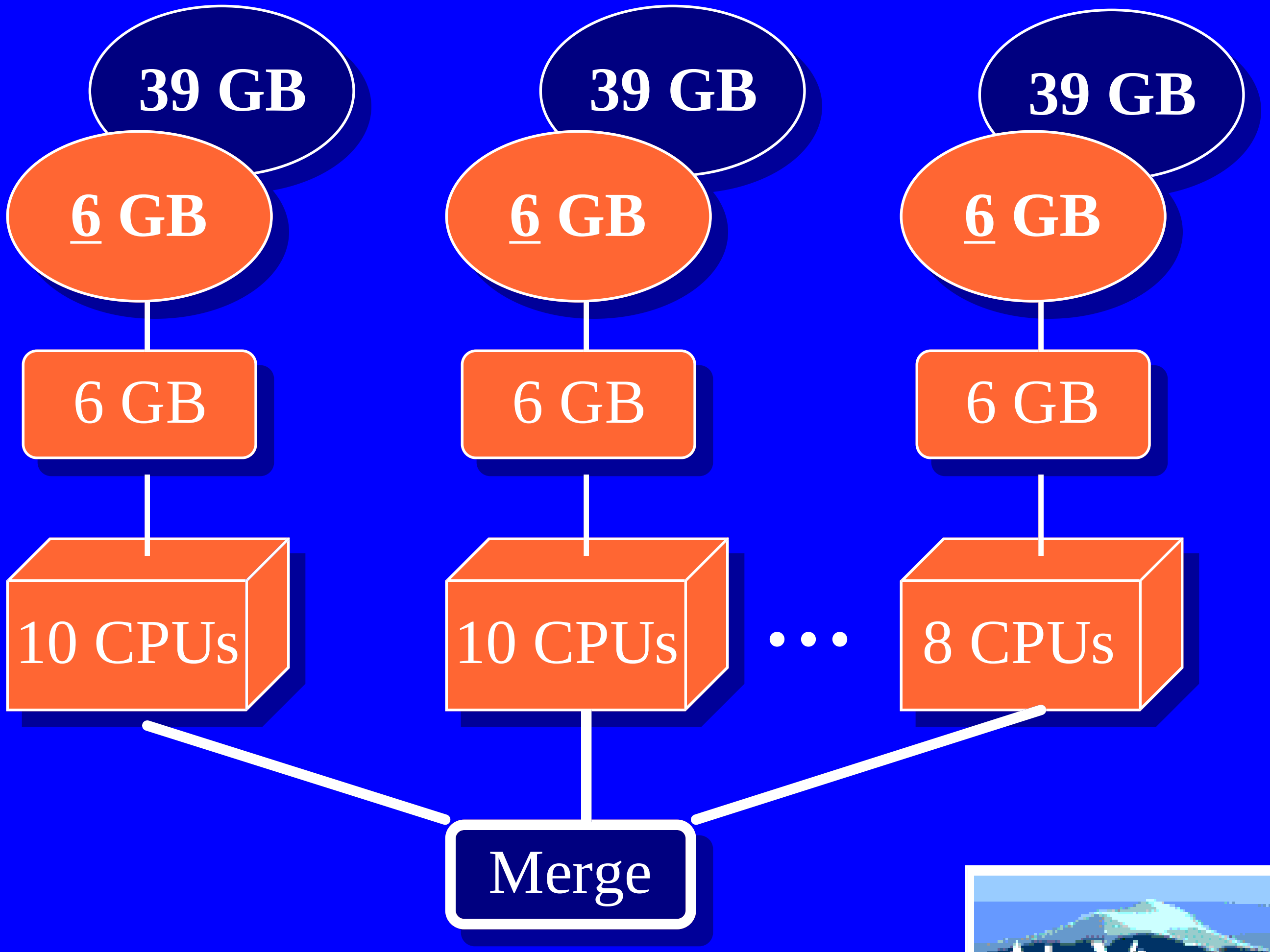
The Index Itself (96/8/29)

- 30M pages, 13B words, 45GB on disk
  - Duplicate (identical) pages indexed only once
- Just the word lists, in alphabetical order
  - “the” has 380,383,961 entries
  - Also a second-level index of just the words
- 45GB cached in 6GB of main memory
  - UNIX mmap of 45GB, paged in/out
- ***NO*** *32-bit machine can do this!*

Index: on 7 machines



Index: eventually, on 7 machines



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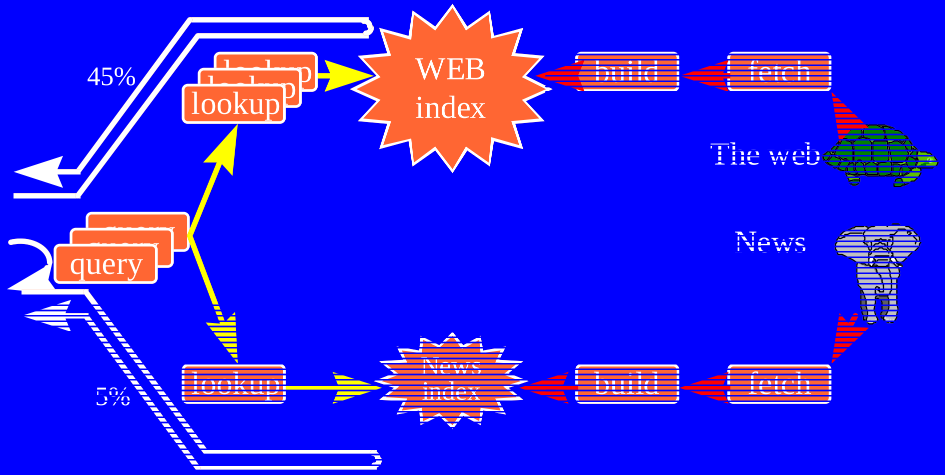
Lookup in Web Index

- Lookups use word lists in index



Lookup in Web Index

- Run through lists for each word in query
- If page has right combination, save URL
- Sort URLs by weighting function
  - Words near front
  - Words repeated
  - Words close together
- Deliver first 200 back to user
  - add summary text

Lookup in Web Index

- Typical lookup takes 1/2 second
- Typical lookup takes 50 disk accesses
- Each TurboLaser has 8 or 10 CPUs, does about 40 lookups & 2000 page faults per second
- Result page points to *originals* (not stored at Digital)
- Weighting details will vary

Queries from the Internet

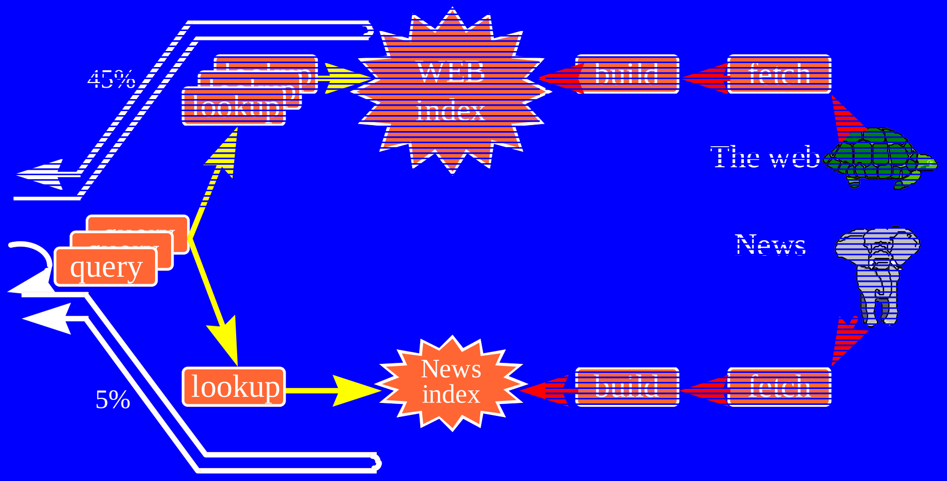
- Incoming queries come to one of three front-end machines
- Front-ends: initial text, help, etc. (50%)
- TurboLasers: web lookups (45%)
- Others: Usenet news lookups (5%)
- FDDI ring connects them all
- Load balancing/failover

Queries: what goes wrong

- Someone: 1000 queries/sec
- Someone: 1..5000 character query
- Many: entire web page as query
- Schools: dozens of simultaneous identical queries
- Major airline: pages duplicated (unauthorized and out of date)

Lookup in News Index

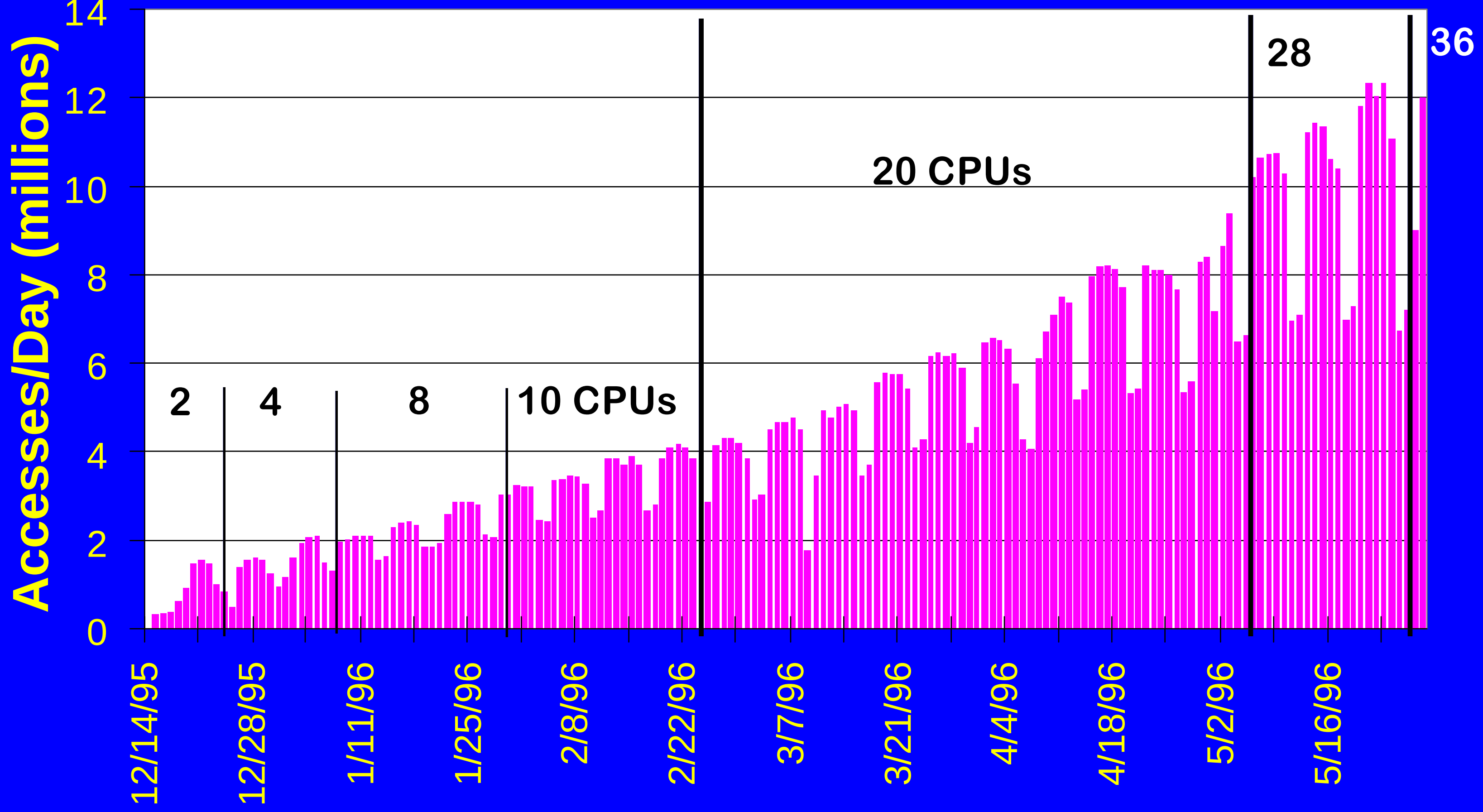
- Lookups use word lists in index



News groups: fetch/build/index/lookup

- Fetch: from 14,000 news groups
- Build: continuously add/delete
- Index: 100x smaller than web
- Lookup: same code
- Result page points to *copies* stored at Digital, and also to *original*
  - via your news server (“L”)
- Load balancing/failover

Statistics: AltaVista load



AltaVista has changed the world!

- Find information
- Answer questions
- Find pictures
- Find long-lost friends
- Correlate newsgroup postings
- Sell products
- Increase commerce

AltaVista

- Fastest, most comprehensive web search
- Free, no advertisements
- Products spinning off:
  - Index corporate intranets
  - Index your PC disks
  - Index mail
  - Mirror sites ...
- *Alpha computers, Digital UNIX*
- ***NO** 32-bit machine can do this!*