Faster Web Transfers

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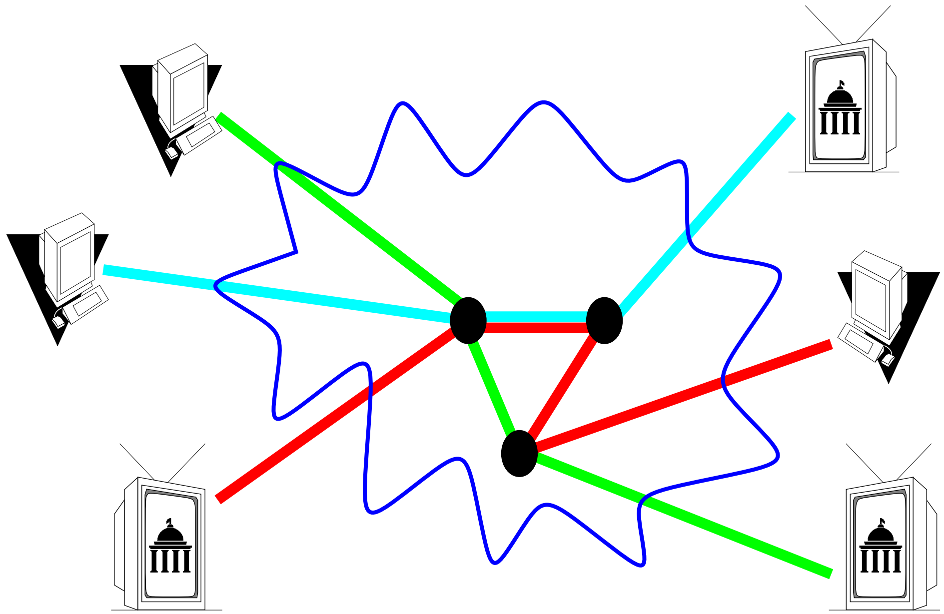
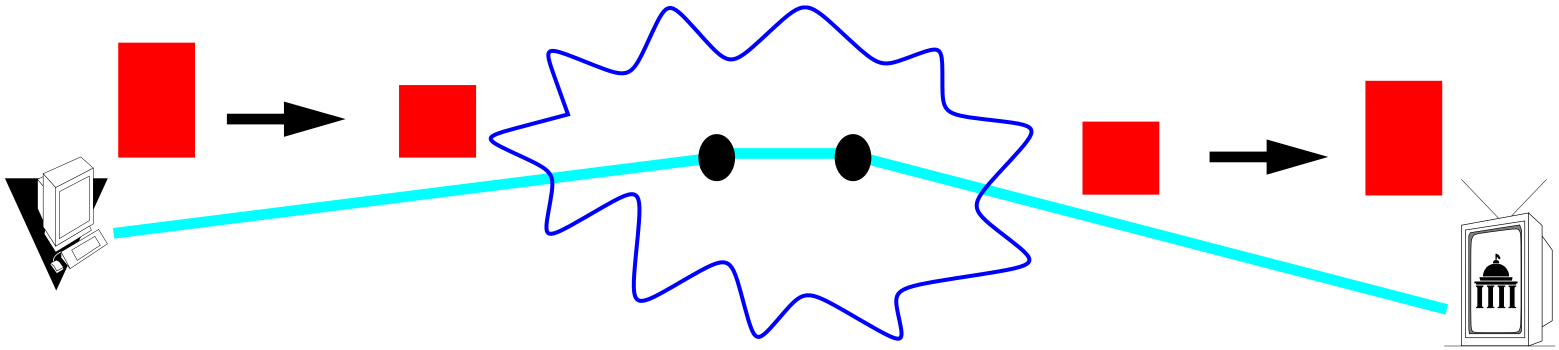
The current World Wide Web



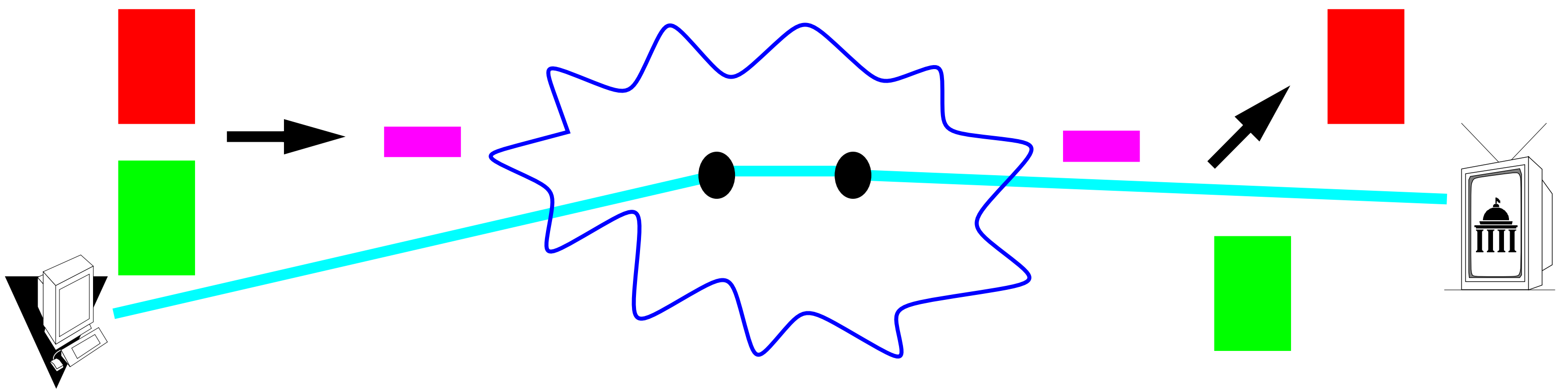
- Inefficient use of network bandwidth
  - uncompressed files
  - naive caching model
    - small changes cause full retransmission

The proposed World Wide Web

- add compression to the transfer protocol (HTTP)



- add delta encoding (only send difference)



- goals: reduce response size and response delay

What did we do?

- Selected set of differencing/compression programs
- Benchmarked via a detailed study
- Proposed modifications to HTTP protocol
- Implemented protocol modifications within Apache server and local client

Differencing Programs

Program	Speed	Size of difference	Restriction
diff -e	fast	large	text only
diff -e | gzip	slow	moderate	text only
vdelta	very fast	very small	

- Currently *vdelta* is not widely available

Compression Programs

- gzip
- vdelta

Field study

- Traced full content for all external Web accesses
    - AT&T
        - data collected from working network using PacketScope
        - 17 days; 19 Gigabytes; 1.4 Million requests
    - Digital Western Research Lab
        - data collected at Web Proxy
        - 2 days; 9 Gigabytes; 0.5 Million requests (does not include images)

Study results: delta encoding (*vdelta* algorithm)

- Delta-eligible: two versions of the same Web page
- Common cases:
  - Personalized Web Pages (e.g. Pointcast)
  - Software downloads
  - Database lookups (e.g. search engines)

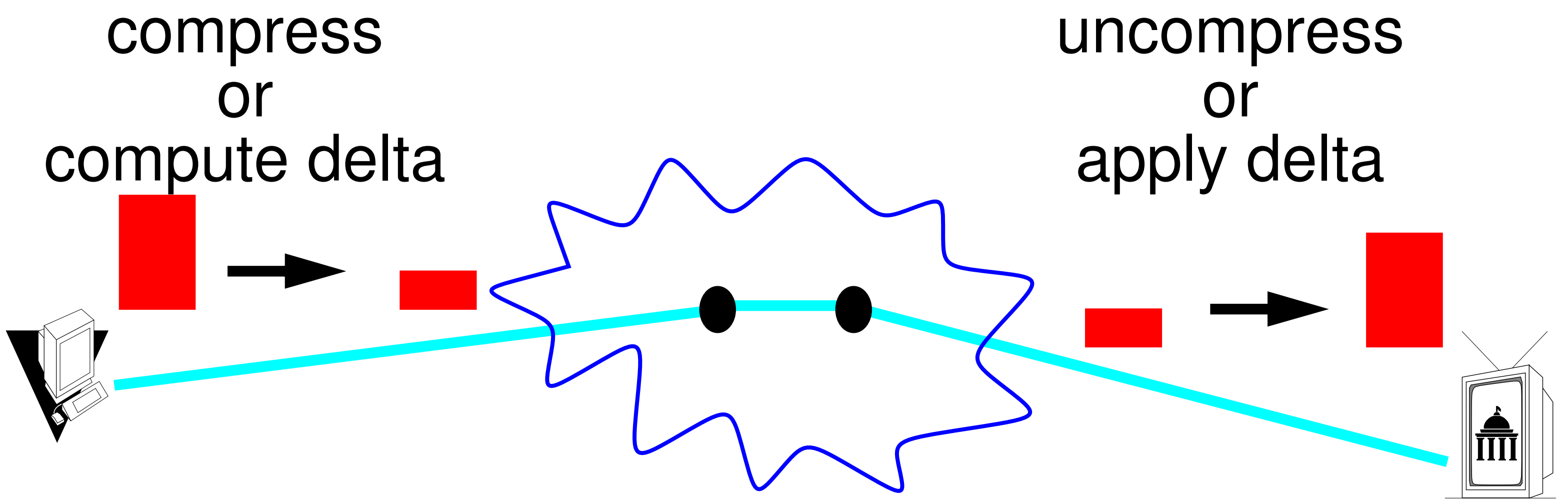
Responses	% smaller	% Bytes saved	% transfer time saved
DEC delta-eligible	99	77	37
DEC all	30	22	11
AT&T delta-eligible	100	82	54
AT&T all	10	8	5

Study results: compression (*gzip* algorithm)

Responses	% smaller	% Bytes saved	% transfer time saved
DEC delta-eligible	65	34	20
DEC all	77	39	22
AT&T delta-eligible	87	44	32
AT&T all	74	21	14

- Deltas: better for delta-eligible responses
- Compression: better for other responses

End-to-End cost



- Measured cost of operations on 486, Pentium, SGI, Alpha
    - Example: *vdelta* throughput

      Pentium: 1.6 Mbytes/second

      Alpha: 3.7 Mbytes/second
    - Comparable to T1

Current Status

- Standardization
  - ftp://ietf.org/internet-drafts/draft-mogul-http-delta-00.txt, "Delta encoding in HTTP",J. Mogul, Y. Goland, Arthur van Hoff, Fred Douglis, Anja Feldmann, Balachander Krishnamurthy, 01/13/1998. (104930 bytes)
- Future work
  - Version management
  - Caching effects
  - Invalidation mechanisms
  - Images