Performance Analysis of the HTTP Protocol on Geostationary Satellite Links

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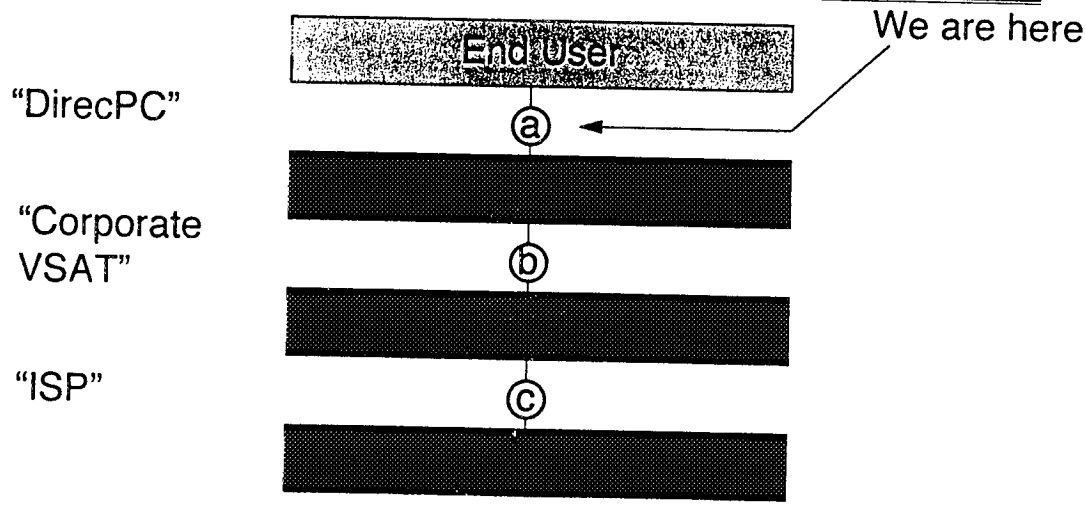
Overview

- Network Reference Points
- The HTTP 1.0 and 1.1 Mechanisms
- Experimental Setup
- TCP and HTTP Configuration
- Results and Future Work

Why HTTP

- The Obvious Answer:
  "Millions of Web Browsers..."
- The not-so-obvious Answer:
  - HTTP is a very generic multi-file transfer protocol with content/encoding awareness
  - Very well optimized HTTP servers are available
  - HTTP contains intrinsic proxy support mechanisms that allow regional caching of data

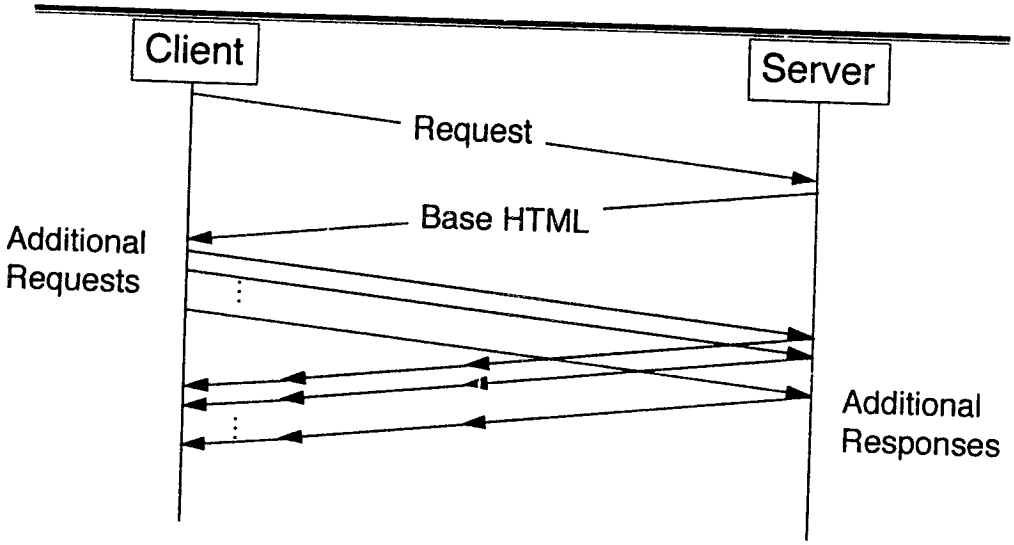
Network Reference Points



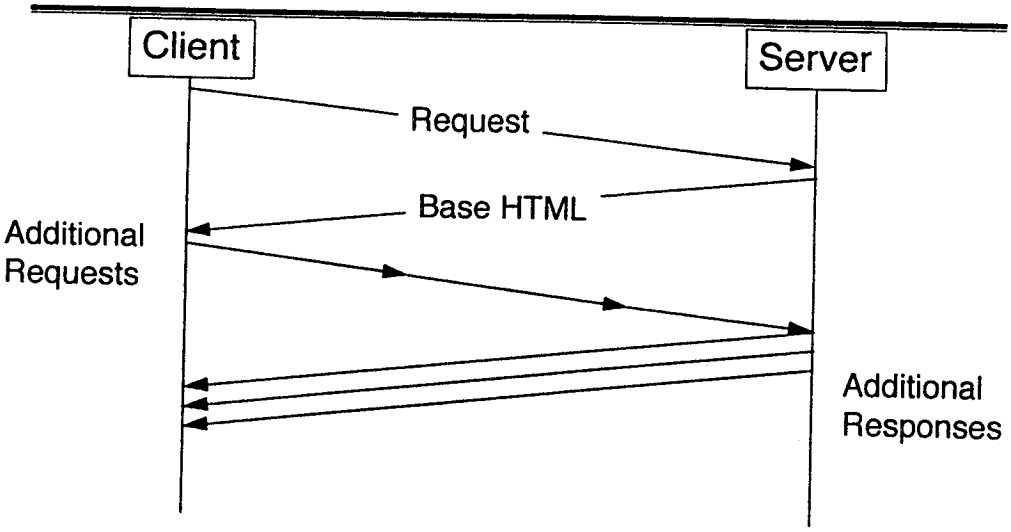
Reference Points cont...

- Interface "a"
  - Very small number of users
  - Traffic is bursty, user wants good response time, protocols dominate performance
- Interfaces "b" and "c"
  - Large and varying number of users
  - Traffic is more random, performance depends on protocols and congestion control; fairness is desirable

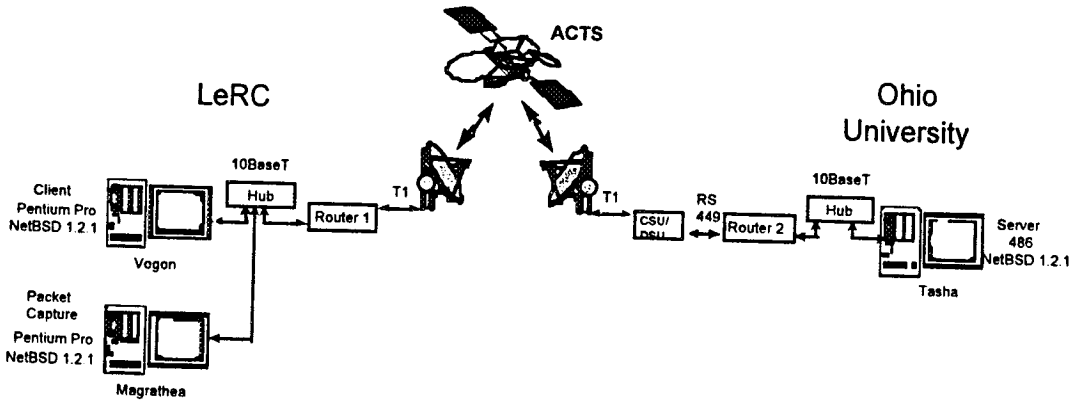
The HTTP 1.0 Mechanism



The HTTP 1.1 Mechanism



The Experimental Setup



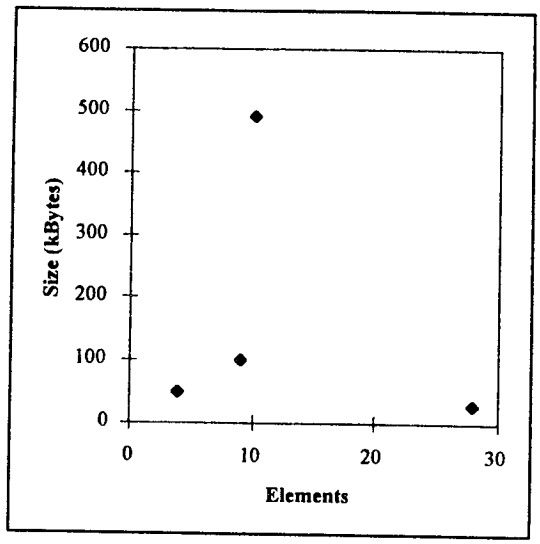
TCP Configuration

- Standard BSD "reno" stack
- Large window support (RFC 1323)
  - experiment uses 8, 16, 64, and 96Kbytes
- Bug fixes in the NetBSD stack
  - Initial window starts with one segment
  - Acknowledgments are generated according to the standard

HTTP Configuration

- Apache Server (HTTP 1.0 and 1.1)
  - Persistent connections in HTTP 1.0
- Netscape browser
- Netscape allows multiple connections
  - experiment uses 1, 4, 8, and 16
- Experimental HTTP 1.1 client
- Increased initial TCP window support

Web Pages



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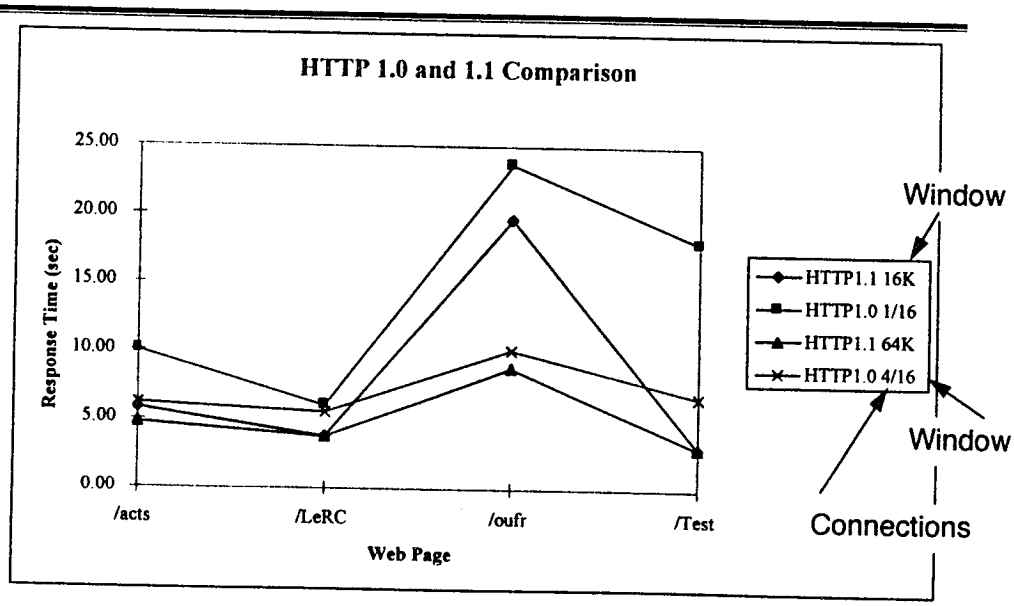
Comparing HTTP 1.0 and 1.1



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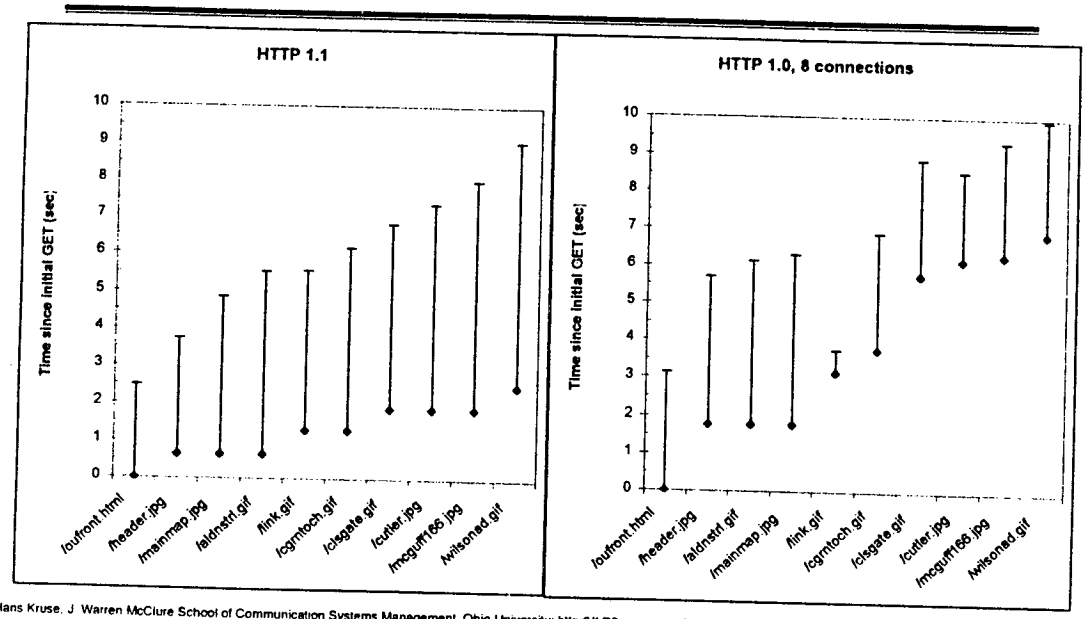
Data Flow Comparison



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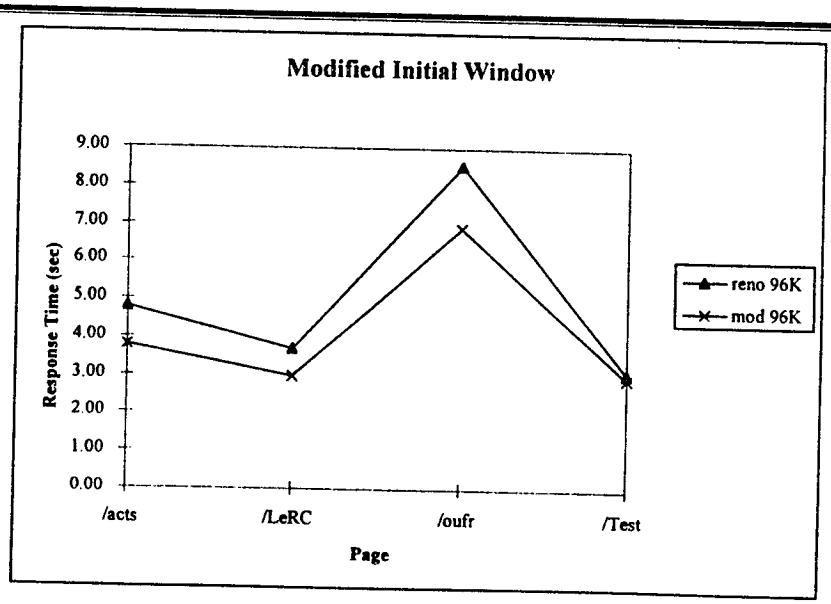
The Larger TCP Initial Window



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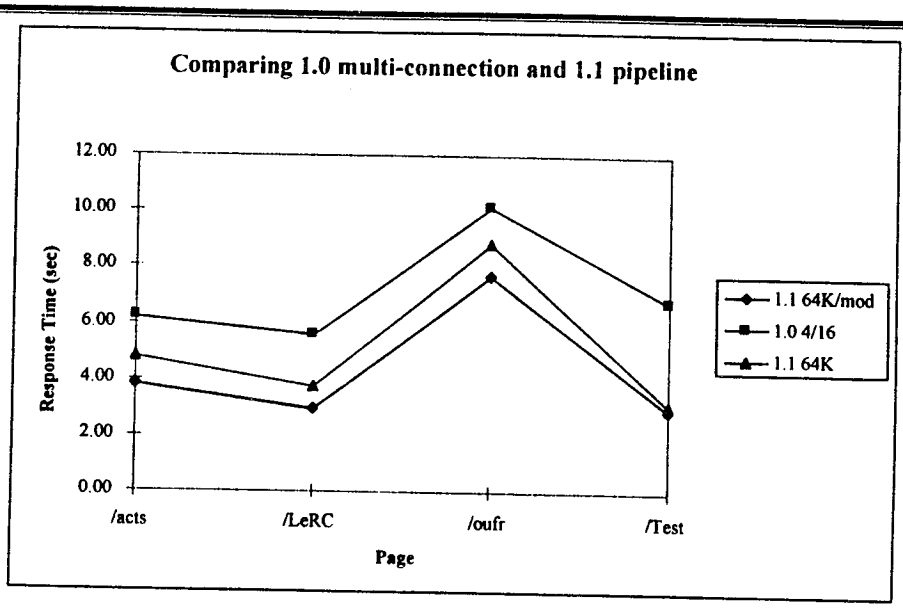
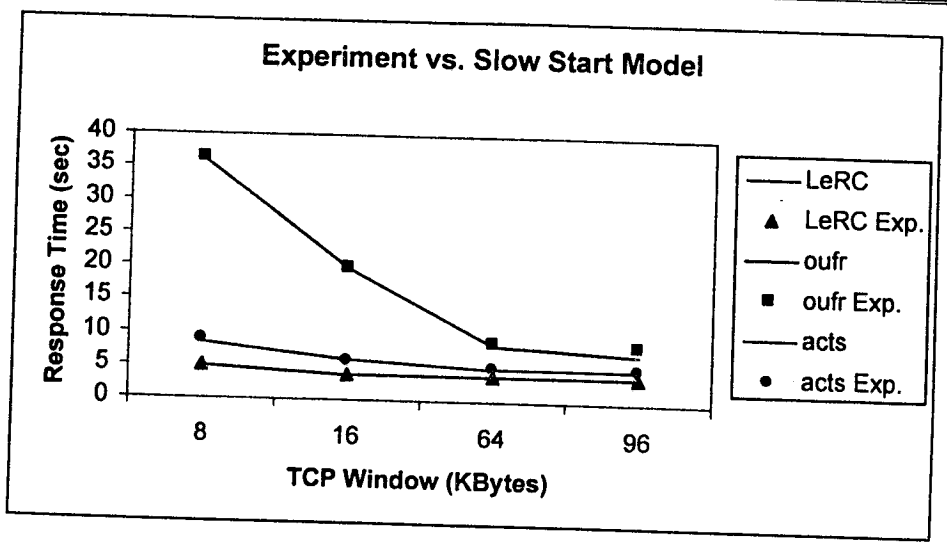
What settings are important?



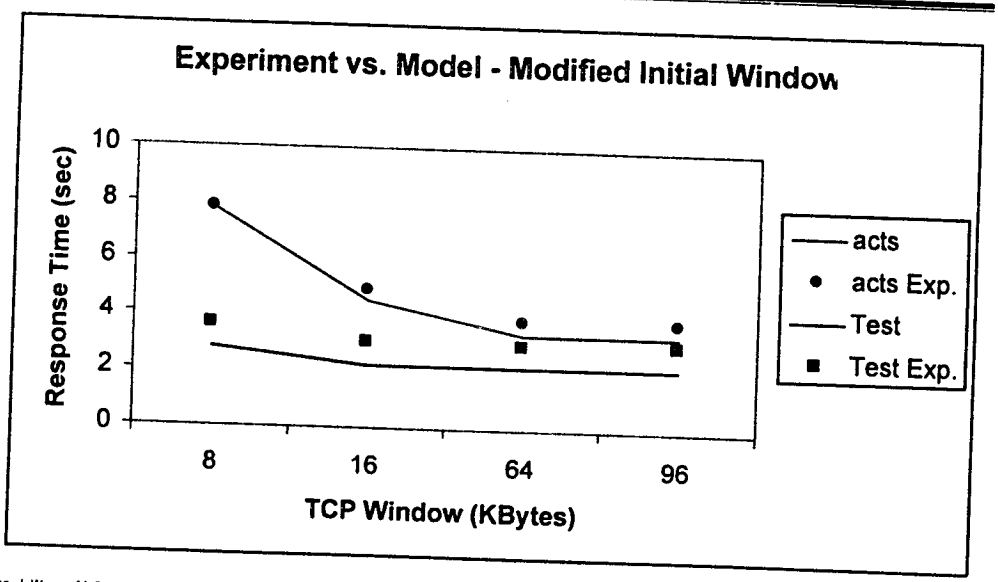
Modeling Slowstart

- Based on Heideman, et al. (IEEE Transactions on Networking Vol. 5, No. 5, Oct 1997.
- Slowstart creates an exponential increase in the data flow, up to the channel bandwidth
- Delayed acknowledgements change the rate of increase
- HTTP 1.0 requires a little extra work, results for HTTP 1.1 are shown here.

Are there unknown effects?



Maybe a few ...

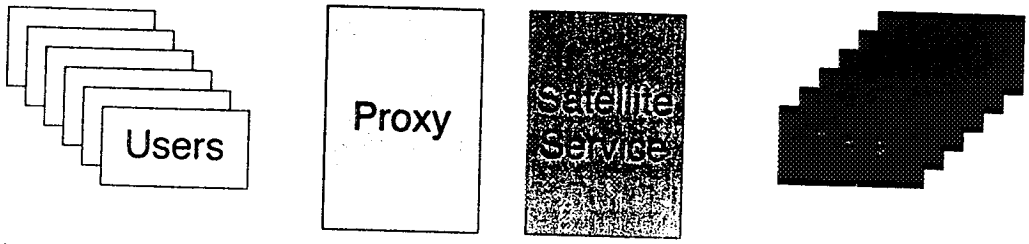


Implication for the Service Provider

Page	Best Time (sec)	Size (Kbytes)	Rate KB/Sec	Utilization	No. of Users
/acts	3.79	100	26.41	14%	7.1
/LeRC	3.00	49	16.36	9%	11.5
/oufr	6.89	491	71.23	38%	2.6
/Test	2.99	29	9.70	5%	19.3

Based on T1 (1.536Mbps) Service

Desirable Configuration:



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Conclusions and Future Work

- HTTP 1.1 pipelining outperforms HTTP 1.0.
- Performance of HTTP 1.1 can be readily modeled.
- Pipelining will create new application level problems.
- Examine the reference points "b" and "c" by introducing competing background traffic with the TCP flow under study.

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