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SlipStream Data Inc. and SlipStream Web Accelerator Client: Comparative Analysis of SlipStream Web Accelerator Client and Propel Accelerator

Test report prepared under contract from SlipStream Data Inc.

Executive summary

SlipStream Data Inc. commissioned VeriTest to compare Web download times of their SlipStream Web Accelerator Client to those of standard unaccelerated Web downloads and Propel Accelerator assisted services using VeriTest's Internet BenchMark™ testing.

The Slipstream Web Accelerator and the Propel Accelerator products access data through a local client proxy that in turn accesses a provider-operated proxy server. These accelerators achieve performance gains in two ways. They implement protocol compression between the provider-operated proxy server and the local client proxy when Internet Explorer requests new or obsolete data. Additionally, these services substitute cached data when a browser requests existing cached data in order to achieve further performance gains.

For these tests, we downloaded 50 different Web pages a minimum of 30 times each using standard Internet BenchMark™ clients called dialbots. Dialbots are personal computers typical of those machines purchased for home use. We tested using our proprietary software with the goal of approximating an end user's experience connecting to and using the Internet during both an initial access of a Web site and an access of a Web site when the cache is already populated. In addition to the proprietary Internet BenchMark™ software, we installed SlipStream Web Accelerator Client version 3.0.37 for our SlipStream testing, Propel Accelerator version 3.0.0.117 for our Propel testing or no other software for our control testing. We used the default graphics settings for both the SlipStream Web Accelerator Client and Propel Accelerator. SlipStream has determined that these settings are equivalent. There was no graphics compression for the control testing.

Key findings

- SlipStream improved download times by up to 5x
- SlipStream accessed first web pages over 33% faster than Propel
- SlipStream improved Web page download times by an Average of 2x
- SlipStream compressed text components of Web pages by an average of 5.9x
- SlipStream compressed Email messages and attachments more than 4.5x for Outlook and Outlook Express
- SlipStream improved average download times by almost 10% over Propel
- SlipStream blocks most pop-ups

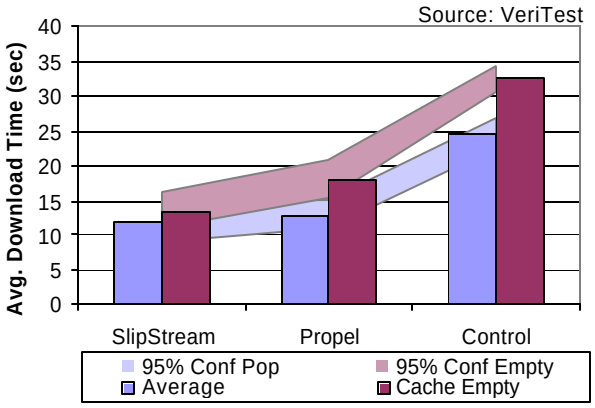


Figure 1: Average Time to Download. Lower values are better.

The results in figure 1 show that the average Web page download using the SlipStream Web Accelerator Client is 2.07 times faster than a download made without an accelerator.

This report contains a detailed methodology including a description of the hardware and software used to collect these data, the methods used to calculate the results and the results from our testing.

Testing methodology: Performance Testing

SlipStream commissioned VeriTest to compare the performance of the following services or clients:

- SlipStream Web Accelerator Client (using a DUN connection)
- Propel Accelerator (using a DUN connection)
- Control (unaccelerated access using a DUN connection)

The Slipstream Web Accelerator and the Propel Accelerator products access data through a local client proxy that in turn accesses a provider-operated proxy server. These accelerators achieve performance gains in two ways. These services substitute cached data when a browser requests existing cached data. Additionally, these services implement protocol compression between the provider-operated proxy server and the local client proxy in order to achieve further performance gains when Internet Explorer requests new or obsolete data.

Hardware

For these tests, we employed the VeriTest Internet BenchMark™ testing equipment to automate the process of connecting to services and requesting a series of URLs with the clients listed above. The goal of the testing was to compare the time to download Web pages for those clients. We downloaded each site with both an empty Internet Explorer cache and an empty accelerator cache and on subsequent downloads with already populated Internet Explorer and accelerator caches.

We performed the testing using nine dialbots. Dialbots are personal computers that are typical of machines purchased for home use. We used Dell OptiPlex GX115 computers with 866-MHz Pentium III processors and 256MB of RAM for this test. We use US Robotics 56K Performance Pro Modems product number USR5610B with hardware version 1.012.0778-D, firmware version 5.22.45 (9/11/01) and DSP version 5.22.45 (9/11/01).

Software

We installed the following software on all of our dialbots:

- Windows Me 4.90.300
- Windows Me Dial-Up Networking (included with this version of Windows Me)
- VeriTest Internet BenchMark™ proprietary testing software
- Internet Explorer 5.50.4807.2300 sp2
- SlipStream Acceleration Client 3.0.37 on the dialbots testing SlipStream
- Propel Accelerator version 3.0.0.117 on the dialbots testing Propel

We connected to the Internet using DUN when we tested the Web page download performance under all circumstances.

Testbed configuration

We configured our testbed in three separate groups of dialbots. We enabled a different set of software in each group. We shifted the function of each group of dialbots

Time Period	Start (UTC)	End (UTC)	Dialbots (128, 129, 130)	Dialbots (131, 132, 134)	Dialbots (135, 136, 137)
Services Tested in Test Period 1	2003-11-01 01:25	2003-11-03 19:28	AT&T WorldNet, Control (No acceleration software)	AT&T WorldNet, Propel Accelerator	AT&T WorldNet, SlipStream Accelerator Client
Services Tested in Test Period 2	2003-11-04 04:29	2003-11-04 23:10	AT&T WorldNet, SlipStream Accelerator Client	AT&T WorldNet, Control (No acceleration software)	AT&T WorldNet, Propel Accelerator
Services Tested in Test Period 3	2003-11-05 08:33	2003-11-05 20:00	AT&T WorldNet, Propel Accelerator	AT&T WorldNet, SlipStream Accelerator Client	AT&T WorldNet, Control (No acceleration software)

Testing Procedure

We configured our dialbots to make Web downloads when the Internet Explorer and Web acceleration product caches were both empty and populated. We accomplished this by configuring each SlipStream, Propel or Control dialbot to clear the Internet Explorer cache and the cache of the applicable acceleration product every time the dialbot rebooted. We configured our dialbots to reboot after at least 100 downloads (two downloads per URL) were competed.

Coverage

For these tests, we dialed the number for AT&T WorldNet in Beaumont, Texas. We evaluated 42 AT&T Pops to determine which POP had a roughly equivalent and short response time to both the SlipStream and Propel compression servers. We measured a response time of just less than 200ms for both servers when dialed from AT&T WorldNet's Beaumont POP. We measured these responses over a 20-hour period on October 20, 2003 and October 21, 2003.

Service Provider	Phone Number
AT&T WorldNet	1-409-767-9010

Web baskets

We call the set of URLs accessed during the test a web basket. These tests used a basket of 50 popular Web pages from sites hosted in the United States. SlipStream selected the Web basket for this test.

Web basket	Web basket
http://www.amazon.com/	http://finance.yahoo.com/
http://www.nytimes.com/	http://www.hotmail.com/
http://www.yahoo.com/	http://www.forbes.com/
http://slashdot.org/	http://online.wsj.com/public/us
http://slate.msn.com/	http://www.howstuffworks.com/
http://www.ebay.com/	http://www.theatlantic.com/
http://www.pcmag.com/	http://www.britannica.com/
http://www.fool.com/	http://www.whitehouse.gov/
http://www.lawmeme.com/	http://www.barnesandnoble.com/
http://www.groklaw.com/	http://www.nyse.com/
http://www.freebsd.org/	http://www.sun.com/
http://www.travelocity.com/	http://dictionary.reference.com/
http://www.expedia.com/	http://www.smh.com/
http://www.msn.com/	http://whatis.techtarget.com/
http://www.microsoft.com/	http://www.nationalpost.com/
http://www.cnn.com/	http://www.loc.gov/copyright/
http://news.bbc.co.uk/	http://www.arstechnica.com/
http://www.paypal.com/	http://www.macobserver.com/
http://news.google.ca/	http://abcnews.go.com/
http://dailynews.yahoo.com/	http://www.nypost.com/
http://www.reuters.com/	http://www.latimes.com/
http://msn.espn.go.com/	http://www.rfc-editor.org/
http://www.cnnsi.com/	http://www.faqs.org/rfcs/rfc2616.html
http://www.foxsports.com/	http://www.nfl.com/
http://www.dell.com/	http://www.cbc.ca/

Figure 2: URLs in Web basket.

Connections

We attempt to make dialup connections with our dialbots. We do not make web downloads when the connection fails and we ignore web downloads made by connections which are questionable. We do not start any downloads until the connection has been stable for 5 seconds. We measure various characteristics of the connections made, such as the amount of time it took to log in and the initial and final modem connect speeds as well as the final modem transmit speed.

Modem connect speed

We report two modem connection speed results for each completed call: one our software takes immediately after the initial modem negotiation and one our software takes immediately after the call termination. We base the initial receive connect speed metric on Windows Me's interpretation of the modem's CONNECT message. This metric reflects the connect speed that the Dialup Networking control panel reports to the end user.

Receive connect speeds reflect the speed of the downstream (provider to end user) portion of the connection; transmit connect speeds are the upstream (end user to provider) speed. Modern standards such as V.34 and V.90 allow asymmetric connect speeds. For example, the maximum receive speed for V.90 connections is currently 54.7 kbps, while the maximum transmit speed is only 33.6 kbps.

The modem connect speed calculations include only successful calls; they do not include calls that negotiate properly and report a connect speed, but fail shortly thereafter because of substandard negotiation or other connection problems.

Network tests

After the dialbot establishes a connection, it may perform one or more network test suites to measure network performance. For these tests, the dialbots made as many downloads as they could without averaging more than 300 seconds per connection (including the time it takes to dial, connect and wait for a 5-second pause, and 8 seconds between each Web page download). The actual number of tests during any given call may vary from zero to 50, based on a random distribution. For the Control tests, each connection executed from zero to 50 Web downloads. For the SlipStream Accelerator Client and the Propel Accelerator, each test suite consisted of two tests: a Traceroute to the acceleration server and from zero to 50 Web page download tests. We randomly selected sites from the Web basket in Figure 2 during each connection.

A failure from the Traceroute test does not affect the information gathered from the Web download.

Web page download

The Web Page Download test measures network performance by using an Internet Explorer browser to download a complete Web page from a remote Web server. This provides an accurate measurement of the reliability and performance of a network connection from a typical end user application.

The dialbot drives the Internet Explorer browser to download a specified Web page.

Our software detects any failure that Internet Explorer reports during the download process (e.g., connection reset by peer). We also use proprietary network traffic monitoring software to determine both the duration of the Web page download and the number of bytes any Web servers transferred to the dialbot during the download. These calculations include all aspects of page content including graphics, frames and Java applets. The test supports secure Web page downloads (HTTPS).

Web Page Download Failures:

Whenever an error message appears as a dialog box for the Internet Explorer browser during a download attempt, we consider it a Web Page Download Failure. We cancel any download that takes longer than four minutes to complete and consider it a Web page timeout. We do not report HTTP errors that remote Web servers return as Web Page Download failures. These errors typically result

from content or Web server problems and not from network problems attributable to Internet Service Providers.

Web Page Time to Download:

The Web Page Time to Download is the time it takes for the complete Web page to download, including all page content. We measure this from the time the dialbot sends the first HTTP TCP packet to the server until the last HTTP TCP connection has terminated.

Web Page Byte Count:

The Web Page Byte Count is the total number of payload bytes the Web server transfers to the client during a Web page download. Providers who use Web accelerators to compress data may have a smaller apparent Web Page Byte Count. For these providers, a lower Web Page Time to Download might not have a correspondingly higher Web Page Throughput.

Web Page Throughput:

The Web Page Throughput is the effective transfer rate of the connection. We derive this measurement by dividing the byte count by the time to download the Web page and we present the result in kilobytes per second (Kbytes/sec). We derive Web Page Throughput for each call. The test reports contain the average Web throughput measurements. Throughput does not necessarily reflect the actual bandwidth of the connection, but rather the effective Web Throughput the provider achieved using a connection.

Statistical Calculations and Data Presentation

We provide 95 percent confidence intervals with most of the averages in the report. These confidence intervals indicate that 95 percent of the time, the actual result would be within the specified range around our measured result. This provides a rough indication of the precision of the metric.

We derive the average Web Page Time to Download using a provider aggregate average of the average performance for each URL. This helps to prevent URL outages or sampling irregularities from biasing results. The corresponding standard deviation is the geometric mean of the per-URL standard deviations.

We calculate the following variables for a given combination of provider and URL:

Variable	Definition
T_{URL}	Average of metric (Time to Download)
SD_{URL}	Standard deviation
S_{URL}	Number of samples

For each provider, we calculate the following variables, which combine results for multiple URLs:

Variable	Definition
T_{ISP}	Average of metric (this is an average of averages)
SD_{ISP}	Standard deviation
N_{URL}	Number of URLs in test
S_{ISP}	Number of samples
M	Harmonic mean of the number of samples
C	95 percent confidence interval

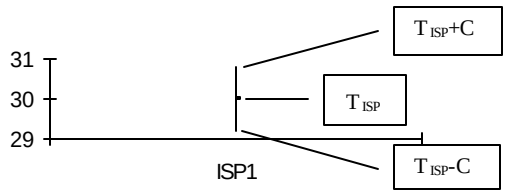
T_{ISP} = an average of averages = $\frac{\sum_{1}^{N_{URL}} T_{URL}}{N_{URL}}$

$SD_{ISP} = \sqrt{\frac{\sum_{1}^{N_{URL}} (S_{URL} * SD_{URL}^2)}{\sum_{1}^{N_{URL}} S_{URL}}}$

$M = \frac{N_{URL}}{\sum_{1}^{N_{URL}} \frac{1}{S_{URL}}}$

$C = 1.96 * \frac{SD_{ISP}}{\sqrt{M}}$

We present graphs with the average metric for each provider and the corresponding 95 percent confidence interval:



Testing Methodology: Compression and Pop-up Blocker Verification

SlipStream commissioned VeriTest to verify that the SlipStream Web Accelerator Client will:

- Compress the size of the text components of non-secure web pages measured in bytes with a compression rate that is on average greater than 5 times
- Compress email message content and attachments
- Block most of the pop-up ads using its integrated pop-up blocker

Hardware

For these tests, we employed two identical Compaq Deskpro EN systems with 600-MHz Pentium III processors and 128MB RAM. We used Pine Model FM-3623-11 Ver 7.0 ESS 2838 Chipset PCI V.92 Modem.

Software

We installed the following software on all of our dialbots:

- Windows Me 4.90.300
- Windows Me Dial-Up Networking (included with this version of Windows Me)
- Internet Explorer 6.0.2800.1106 Update Version: SP1, Q828750; Q330994
- Ethereal Version 0.9.15 with WinCap 3.0
- Outlook 2002 (10.4219.4219) SP-2
- Outlook Express 6.00.2800.1123
- Eudora Version 6.0.0.22
- Slipstream Version 3.0.

Testing Procedure: Web Page Compression

We built two identical computers from the same image, and installed the SlipStream Acceleration Client on one. We surfed to each of seven pages in our Web Page Compression Web Basket three times on each configuration, on three consecutive days. We used Ethereal to record all packet information. We applied filters to the Ethereal logs to analyze only the datastream coming from SlipStream or the Web site under test. We set Internet Explorer to not show any pictures or graphics.

Web basket: Web Page Compression

Non-Secure Websites
http://www.reuters.com/
http://www.travelocity.com
http://www.nytimes.com/
http://www.groklaw.com/
http://www.amazon.com/
http://news.bbc.co.uk/
http://online.wsj.com/

Testing Procedure: Email Compression

We built two identical computers from the same image, and installed the SlipStream Acceleration Client on one. We sent a variety of emails of the same length, with varied attachment types from both systems using Outlook, Outlook Express and Eudora. Ethereal recorded all packets.

Attachments: Email Compression

Msg #	Msg Size (KB)	Attachment Type
1	25	Word Document
2	26	Word Document
3	27	Word Document
4	28	Word Document
5	29	Word Document
6	21	Excel spreadsheet
7	24	Excel spreadsheet
8	26	Excel spreadsheet
9	30	Excel spreadsheet
10	32	Excel spreadsheet

Testing Procedure: Pop-Up Blocker

We built two identical computers from the same image, and installed the SlipStream Acceleration Client on one. We surfed to 12 Web pages that use multiple pop-ups using both systems. We repeated the process 4 times. Ethereal recorded all packets.

Web basket: Pop-Up Blocker

Pop-up Websites
http://www.forbes.com
http://www.aol.com
http://www.xpsoft.com/test.asp
http://www.popuptest.com/popuptest1.html
http://www.meaya.com/testpop/testpop.htm
http://www.nytimes.com
http://www.consumerinfo.com
http://www.real.com
http://www.mcafee.com
http://www.netscape.com
http://www.ew.com
http://www.time.com

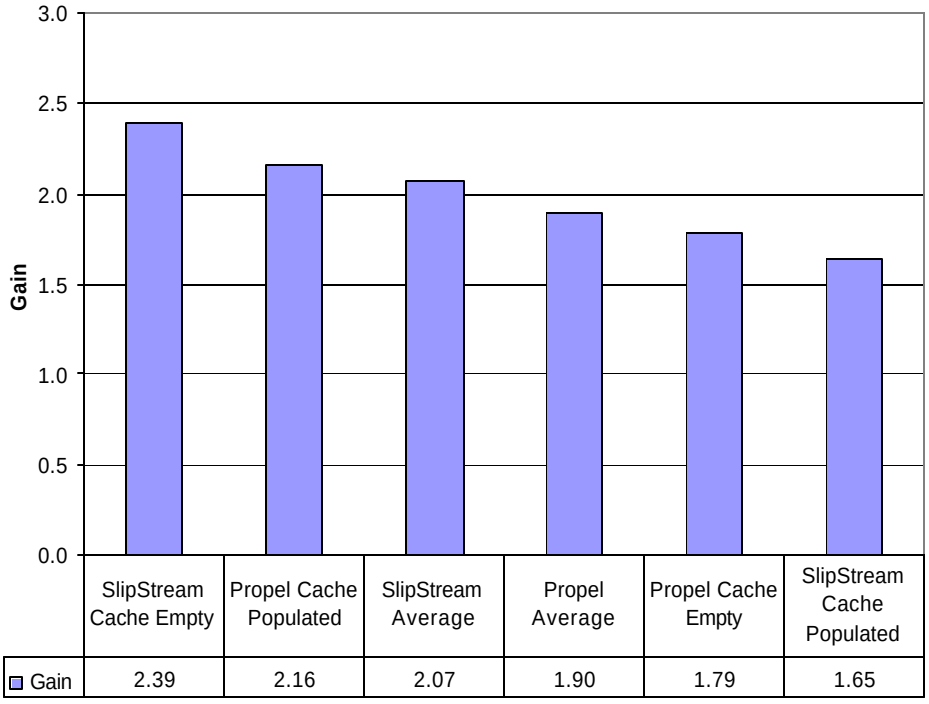
Coverage: Compression and Pop-up Blocker Verification

For these tests, we dialed the number for AT&T WorldNet in Beaumont, Texas.

Service Provider	Phone Number
AT&T WorldNet	1-409-767-9010

Test results

Figure 3 shows the average gain for each tested configuration. The SlipStream Acceleration Client provided a gain of 2.07x the performance of Internet Explorer alone when we weight the cleared cache downloads equally to the populated cache downloads in our average.

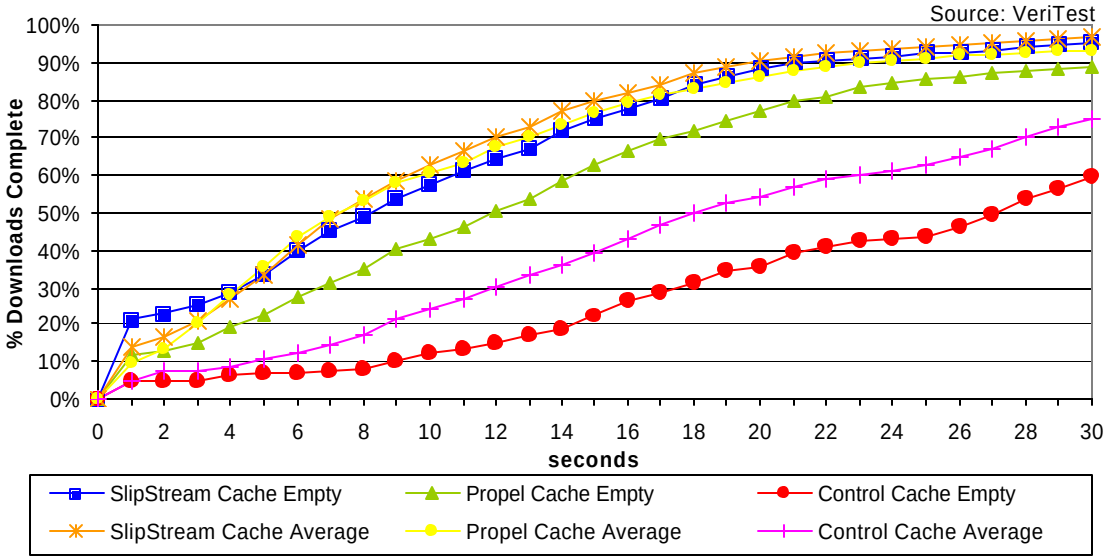


Condition	Gain
SlipStream Cache Empty	2.39
Propel Cache Populated	2.16
SlipStream Average	2.07
Propel Average	1.90
Propel Cache Empty	1.79
SlipStream Cache Populated	1.65

Figure 3: Average Gain by test condition

Figure 4 shows a cumulative distribution of the percentage of completed downloads within a given time period. We calculate these values as the average percentage of each Web page completed within each time period, so that we weight each Web page equally in the final value.

The SlipStream Accelerator Client downloaded 57.2% of the Web pages with an empty cache within 10 seconds. The Propel Accelerator downloaded 40.4% of the Web pages with an empty cache within 10 seconds.

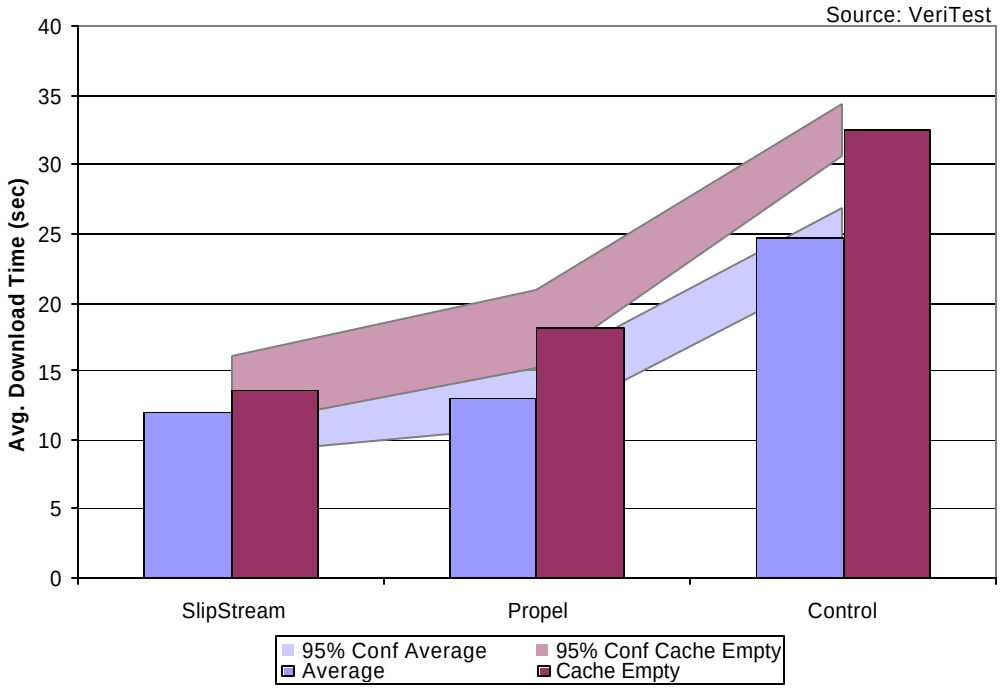


Condition / seconds	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SlipStream Cache Empty	21.3%	22.7%	25.4%	28.8%	33.5%	39.7%	45.5%	48.9%	53.6%	57.2%	61.1%	64.5%	67.2%	71.7%	74.8%
Propel Cache Empty	11.7%	12.7%	15.1%	19.0%	22.6%	27.5%	31.3%	35.3%	40.4%	43.1%	46.5%	50.7%	53.8%	58.3%	62.8%
Control Cache Empty	4.8%	4.8%	4.8%	6.5%	6.7%	7.2%	7.6%	7.9%	10.4%	12.0%	13.5%	14.8%	17.1%	18.8%	22.4%
SlipStream Cache Average	14.0%	16.7%	21.0%	26.9%	33.6%	41.4%	48.5%	53.9%	58.5%	62.6%	66.7%	70.1%	72.9%	77.1%	79.7%
Propel Cache Average	9.6%	13.5%	20.1%	28.2%	35.9%	43.4%	49.0%	53.4%	57.9%	60.5%	63.4%	67.6%	70.3%	73.4%	76.6%
Control Cache Average	4.7%	7.3%	7.4%	8.7%	10.8%	12.3%	14.6%	17.1%	21.1%	24.0%	27.0%	30.1%	33.6%	36.0%	39.3%

Condition / seconds	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
SlipStream Cache Empty	74.8%	77.9%	80.6%	83.9%	86.1%	88.1%	89.8%	90.5%	91.1%	91.7%	92.3%	92.8%	93.2%	93.9%	94.8%
Propel Cache Empty	62.8%	66.3%	69.6%	72.0%	74.5%	77.1%	79.7%	80.8%	83.3%	84.3%	85.4%	86.4%	87.1%	87.8%	88.3%
Control Cache Empty	22.4%	26.4%	28.7%	31.5%	34.4%	35.8%	39.2%	41.2%	42.4%	43.0%	43.8%	46.3%	49.5%	53.5%	56.6%
SlipStream Cache Average	79.7%	81.9%	84.2%	87.0%	88.9%	90.4%	91.7%	92.4%	92.9%	93.5%	94.3%	94.8%	95.2%	95.8%	96.4%
Propel Cache Average	76.6%	79.1%	81.2%	82.9%	84.4%	86.2%	87.7%	88.6%	90.0%	90.6%	91.2%	91.8%	92.2%	92.6%	92.9%
Control Cache Average	39.3%	43.1%	47.1%	49.9%	52.6%	54.4%	57.0%	58.8%	60.1%	61.3%	62.7%	64.8%	67.2%	70.1%	72.8%

Figure 4: Percent of Downloads completed within a given time. Higher values at earlier times are better.

The results in Figure 5 show that the Internet BenchMark™ software measured a 1.06 second difference between the average time it takes the SlipStream Accelerator Client to download a complete Web page and the average time it takes the Propel Accelerator to download a complete Web page. The difference is statistically significant to a 70% confidence level. SlipStream Accelerator Client downloads pages more than twice as fast as the Control service does when the cache is not populated.



Test Condition	Time to Download (sec)	StdDev	Downloads
SlipStream Average	11.93	14.38	17184
SlipStream Cache Empty	13.57	9.65	2664
Propel Average	12.99	10.83	19133
Propel Cache Empty	18.14	11.87	3417
Control Average	24.70	10.59	13154
Control Cache Empty	32.47	7.36	2907

Figure 5: Average Download Time by test condition. Lower times are better.

The results in Figure 6 show average download times broken down by URL and test condition. We have truncated the URL names for display. When you see a URL that is missing a top-level domain, you can assume that it is a .com URL. All URLs have had "http://" or "http://www." removed from the beginning of the URL name.

Condition URL	abcnews.go	dailynews.yahoo	dictionary.reference	msn.espn.go	news.bbc.co.uk/	news.google.ca/	online.wsj
SlipStream Cache Empty	26.06	6.92	6.58	26.75	11.60	10.07	13.91
Propel Cache Empty	21.62	10.57	4.18	81.40	15.37	8.41	22.79
Control Cache Empty	61.19	15.35	7.76	50.70	27.22	20.81	43.43
SlipStream Average	22.66	5.33	5.99	22.54	9.43	9.56	13.37
Propel Average	18.40	7.85	3.65	49.44	10.23	8.45	15.59
Control Cache Populated	30.98	7.44	7.09	25.74	10.34	20.35	24.74
SlipStream Cache Populated	19.27	3.75	5.41	18.33	7.26	9.04	12.82
Propel Cache Populated	15.18	5.14	3.13	17.47	5.10	8.49	8.39
Control Average	46.09	11.40	7.42	38.22	18.78	20.58	34.09

Condition URL	slashdot.org/	whatis.techtarget	amazon	arstechnica	barnesandnoble	britannica	cbc.ca/
SlipStream Cache Empty	2.02	9.02	26.06	26.06	26.06	15.55	13.19
Propel Cache Empty	3.10	11.42	21.62	21.62	21.62	9.34	15.75
Control Cache Empty	3.97	19.01	61.19	61.19	61.19	26.60	32.39
SlipStream Average	1.75	7.40	22.66	22.66	22.66	14.80	11.85
Propel Average	3.34	8.42	18.40	18.40	18.40	7.05	12.03
Control Cache Populated	1.22	13.75	30.98	30.98	30.98	17.12	12.76
SlipStream Cache Populated	1.47	5.77	19.27	19.27	19.27	14.04	10.50
Propel Cache Populated	3.57	5.41	15.18	15.18	15.18	4.76	8.31
Control Average	2.60	16.38	46.09	46.09	46.09	21.86	22.57

Condition URL	cnn	cnnsi	dell	ebay	expedia	faqs.org/rfcs/rfc2616.html	fool
SlipStream Cache Empty	18.24	30.83	18.35	16.98	9.64	6.03	13.43
Propel Cache Empty	22.37	48.62	8.73	19.37	14.00	15.94	16.06
Control Cache Empty	36.95	85.46	17.08	27.96	20.63	21.51	35.17
SlipStream Average	15.55	24.95	37.81	10.68	8.14	3.81	10.41
Propel Average	14.77	34.60	6.38	11.60	9.65	8.98	11.52
Control Cache Populated	15.28	28.50	10.17	6.57	16.54	2.56	13.72
SlipStream Cache Populated	12.86	19.07	57.26	4.38	6.65	1.59	7.38
Propel Cache Populated	7.17	20.57	4.03	3.83	5.31	2.02	6.99
Control Average	26.12	56.98	13.63	17.27	18.59	12.03	24.45

Condition URL	forbes	foxsports	freebsd.org/	groklaw	hotmail	howstuffworks	latimes
SlipStream Cache Empty	31.54	28.99	3.67	6.08	9.49	21.91	22.88
Propel Cache Empty	40.97	48.81	5.46	8.03	9.20	43.70	24.36
Control Cache Empty	78.10	81.07	8.97	13.03	15.28	65.83	52.42
SlipStream Average	28.97	24.82	2.67	6.47	8.71	17.51	20.53
Propel Average	31.00	31.97	3.40	7.17	8.16	28.24	20.71
Control Cache Populated	74.25	35.18	2.27	10.92	10.91	18.35	25.66
SlipStream Cache Populated	26.39	20.66	1.66	6.86	7.93	13.12	18.19
Propel Cache Populated	21.03	15.13	1.34	6.31	7.12	12.77	17.05
Control Average	76.17	58.12	5.62	11.98	13.09	42.09	39.04

Condition URL	lawmeme	loc.gov/copyright/	macobserver	microsoft	msn	nfl	nypost
SlipStream Cache Empty	7.55	6.58	15.63	13.75	8.46	11.00	12.35
Propel Cache Empty	12.73	10.13	16.71	11.29	9.64	11.58	20.06
Control Cache Empty	17.91	14.64	53.84	27.49	17.42	22.41	57.04
SlipStream Average	6.30	5.61	13.61	11.61	5.92	9.88	11.57
Propel Average	10.11	6.85	14.62	7.59	6.78	8.37	16.38
Control Cache Populated	8.17	7.68	24.88	10.84	6.13	9.05	29.20
SlipStream Cache Populated	5.05	4.63	11.60	9.47	3.37	8.75	10.80
Propel Cache Populated	7.49	3.57	12.54	3.90	3.92	5.16	12.71
Control Average	13.04	11.16	39.36	19.16	11.78	15.73	43.12

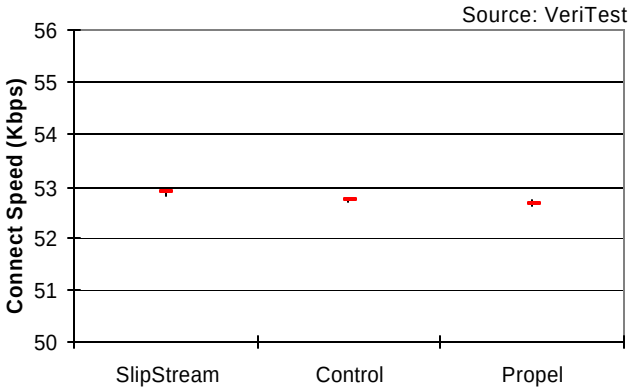
Condition URL	nyse	nytimes	paypal	pcmag	reuters	rfc-editor.org/	sun
SlipStream Cache Empty	8.13	15.52	4.98	23.74	17.39	2.02	4.36
Propel Cache Empty	12.70	18.98	5.89	30.26	21.73	3.10	5.24
Control Cache Empty	29.67	31.85	12.76	55.55	32.69	3.97	14.97
SlipStream Average	6.74	11.99	4.19	18.58	15.80	1.75	3.61
Propel Average	8.74	13.01	4.10	21.75	18.26	3.34	3.73
Control Cache Populated	17.47	20.34	12.50	31.84	21.77	1.22	4.50
SlipStream Cache Populated	5.36	8.46	3.40	13.43	14.21	1.47	2.85
Propel Cache Populated	4.78	7.03	2.31	13.24	14.79	3.57	2.22
Control Average	23.57	26.09	12.63	43.69	27.23	2.60	9.73

Condition URL	theatlantic	travelocity	yahoo	slate.msn	finance.yahoo	whitehouse.gov/	smh
SlipStream Cache Empty	9.69	9.02	5.79	2.02	6.03	9.02	2.02
Propel Cache Empty	12.75	11.42	7.42	3.10	15.94	11.42	3.10
Control Cache Empty	28.22	19.01	12.59	3.97	21.51	19.01	3.97
SlipStream Average	7.93	7.40	4.21	1.75	3.81	7.40	1.75
Propel Average	10.14	8.42	5.24	3.34	8.98	8.42	3.34
Control Cache Populated	11.90	13.75	5.11	1.22	2.56	13.75	1.22
SlipStream Cache Populated	6.18	5.77	2.63	1.47	1.59	5.77	1.47
Propel Cache Populated	7.52	5.41	3.06	3.57	2.02	5.41	3.57
Control Average	20.06	16.38	8.85	2.60	12.03	16.38	2.60

Condition URL	nationalpost
SlipStream Cache Empty	8.46
Propel Cache Empty	9.64
Control Cache Empty	17.42
SlipStream Average	5.92
Propel Average	6.78
Control Cache Populated	6.13
SlipStream Cache Populated	3.37
Propel Cache Populated	3.92
Control Average	11.78

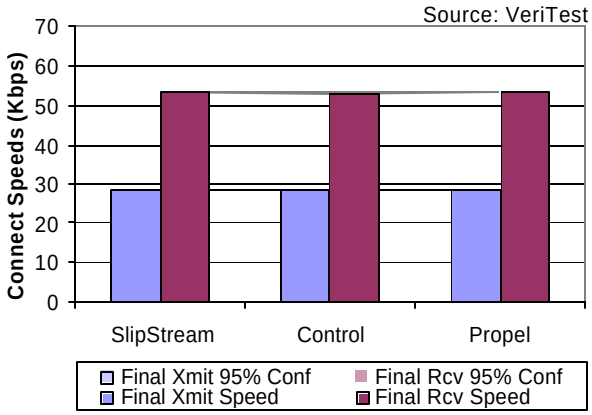
Figure 6: Time to Download displayed by URL and test condition. Lower values are better.

Figure 7 and Figure 8 show that the connection speeds measured for all of the connection clients were no better or worse for any service tested. Therefore, the measured download performance differences are not due to superior connections.



Connections	Initial Receive Connect Speed (Kbps)	StdDev	Successful Connections
SlipStream	52.89	1.21	2788
Control	52.74	1.28	3056
Propel	52.69	1.41	2630

Figure 7: Initial Connect Speed. Higher values are better.



Service	Final Receive Speed (Kbps)	Final Receive StdDev	Final Transmit Speed (Kbps)	Final Transmit StdDev	Successful Connections
SlipStream	53.3	0.8	28.7	0.6	2648
Propel	53.2	1.0	28.7	0.5	2629
Control	53.1	1.0	28.7	0.5	2115

Figure 8: Final Connect Speeds. Higher values are better.

Figure 9 shows that SlipStream decreased the size of the text portion for each page. SlipStream decreased the size of the text portions of the pages by 3.79x on the first attempt, 8.56x on the second attempt and 10.21x on the third download attempt.

	SlipStream (bytes)			Control (bytes)		
Web Sites \ Attempt	1	2	3	1	2	3
http://www.reuters.com	29214	32451	8754	166317	120134	13780
http://www.travelocity.com	21511	3444	3786	116107	115918	116412
http://www.nytimes.com	24491	8405	21678	120242	73205	127500
http://www.groklaw.com	3087	4244	3924	82669	80252	71132
http://www.amazon.com	11857	2742	2844	14671	14408	14526
http://news.bbc.co.uk	17609	11561	11389	91789	84997	91555
http://online.wsj.com	118902	19348	8469	266567	214467	186037

Figure 9: Text compression by test. The lower the value in the SlipStream trial compared to the value in the control trial, the higher the compression.

Figure 10 shows that SlipStream significantly decreases the size of the email payloads measured.

Msg	Size_Sent(KB)	Control Size_Received(KB)			SlipStream Size Received(KB)		
		Eudora	Outlook	OE	Eudora	Outlook	OE
1	25	38	39	39	20	9	8
2	26	39	40	40	21	8	8
3	27	42	41	41	21	12	9
4	28	43	42	42	23	9	9
5	29	45	44	44	42	11	7
6	21	32	30	30	16	7	7
7	24	37	36	36	18	8	7
8	26	41	39	41	19	11	8
9	30	47	45	46	21	10	9
10	32	51	50	50	24	10	10

Figure 10: Email compression by test. The lower the value in the SlipStream trial compared to the value in the control trial, the higher the compression. (OE = Outlook Express.)

Figure 11 shows that SlipStream blocks most Pop-Up windows.

Trial	1		2		3		4	
Web Sites	Control	SlipStream	Control	SlipStream	Control	SlipStream	Control	SlipStream
http://www.aol.com	1	0	1	0	1	0	1	0
http://www.consumerinfo.com	1	0	1	0	1	0	1	0
http://www.ew.com	1	0	0	0	0	0	0	0
http://www.forbes.com	1	0	1	0	1	0	1	0
http://www.mcafee.com	1	0	0	0	1	0	0	0
http://www.meaya.com/testpop/testpop.htm	4	1	4	0	4	0	4	0
http://www.netscape.com	2	0	1	0	0	0	0	0
http://www.nytimes.com	1	0	0	0	0	0	0	0
http://www.popuptest.com/popuptest1.html	8	1	8	1	8	1	8	1
http://www.real.com	2	1	1	1	1	1	1	1
http://www.time.com	1	0	1	1	0	0	0	0
http://www.xpsoft.com/test.asp	6	1	6	1	5	1	5	1
Grand Total	29	4	24	4	22	3	21	3

Figure 11: Pop-ups not blocked. Lower values are better.

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