



# Data Optimization Benchmark over HSDPA

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# 1 INTRODUCTION

This document is a summary of the third annual report for Flash Networks Data Optimization performance analysis of the Alexa benchmark.

The objective of the Benchmark project is better understanding of the browsing download time experience, identifying correlations between sites attributes and download times (with and without optimization), as well as measuring the potential of acceleration features based on the changing internet trends.

## 1.1 Benchmark sites

The benchmark is based on the Alexa web search site ([www.alexa.com](http://www.alexa.com)). This site is well known and we believe that it can be used as valid reference. The selected benchmark is based on the top 100 URLs of 59 countries, altogether, 5900 URLs.

Since the data collection process is time consuming, it was decided to select from the 5900 URLs only the ones that are shared by at least 3 different countries, altogether, 355 URLs.

## 1.2 Configuration

Optimization configuration included all features with original image quality (no color reduction was induced).

## 1.3 Measurement Methodology

The project was running on the live Orange Israel HSDPA network.

Two APNs that allows access to the optimization system were dedicated to the testing. These APNs are routed through almost an identical route, only that one is used to access the Internet through the optimization system and the second to access the Internet directly.

The measurements were automatically performed using internal testing software, by browsing to groups of 3 sites each time – once for none-optimized (TCP), and the other for optimized in clientless mode (CLS). This was repeated until 10 measurements were taken from each site both for TCP and for CLS.

One laptop was used in the testing with standard configuration (WinXP, IE7). This method was used in order to measure both optimized and none-optimized while running in similar network conditions.

## 2 RESULTS

Out of 355 URLs, we managed to measure 330 sites. The rest of the sites were eliminated from the results analysis process since most of their measurements generated timeouts (TCP or CLS) or due to the testing software problems. A measurement was eliminated if it had fewer than 6 samples in either CLS or TCP.

The standard deviation for TCP time was 30% of the TCP time.

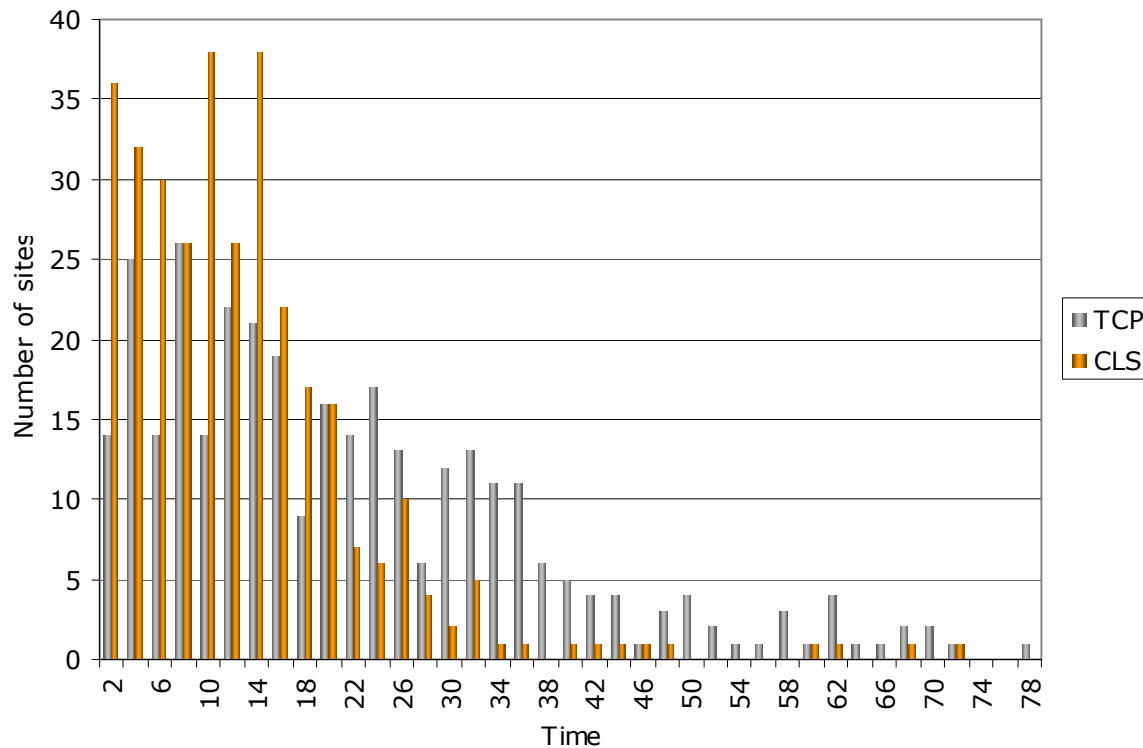
The standard deviation for CLS time was 23% of the CLS time.

Since all sites had at least 6 samples, and most had 10, this is an acceptable value.

All results were manually reviewed to make sure that they are valid.

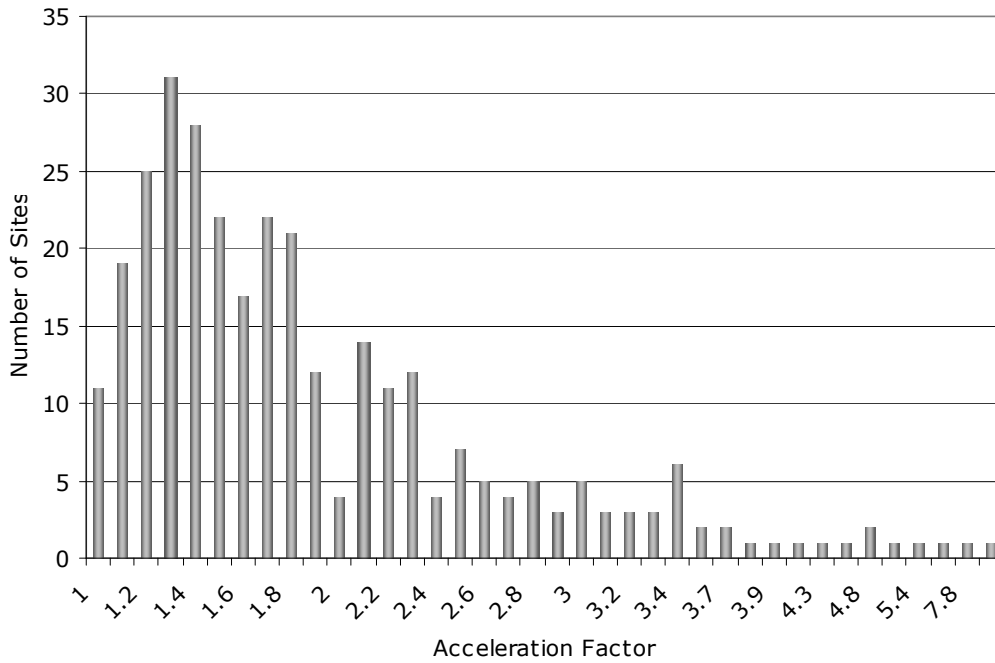
### 2.1 The Overall Picture

The following charts show the overall results (TCP download time and acceleration factors), and their distribution. For example, there are 30 events (sites) that have a download time of 6 sec (CLS).



**FIGURE 1 – DOWNLOAD TIME DISTRIBUTION**

Acceleration factors represent the ratio between original download time and optimized download time and are calculated by dividing the original download time with the optimized download time (Original time/Optimized time). Acceleration factor distribution is presented hereby.



**FIGURE 2 – ACCELERATION FACTOR DISTRIBUTION**

## 2.2 Summary Tables

Both average and median are given below. In general, we recommend using the median result since the average is very sensitive to extreme values.

<i>Subgroup</i>	<i>Distribution %</i>	<i>Average Acceleration Factor</i>	<i>Median Acceleration Factor</i>
<b>TCP download time &lt; 5 sec</b>	<b>8%</b>	<b>1.38</b>	<b>1.37</b>
<b>5 sec &lt;= TCP download time &lt; 10 sec</b>	<b>16%</b>	<b>1.68</b>	<b>1.54</b>
<b>10 sec &lt;= TCP download time &lt; 20 sec</b>	<b>25%</b>	<b>1.54</b>	<b>1.50</b>
<b>20 sec &lt;= TCP download time &lt; 30 sec</b>	<b>20%</b>	<b>1.80</b>	<b>1.67</b>
<b>30 sec &lt;= TCP download time &lt; 40 sec</b>	<b>16%</b>	<b>2.18</b>	<b>2.15</b>
<b>40 sec &lt;= TCP download time &lt; 50 sec</b>	<b>5%</b>	<b>2.04</b>	<b>1.77</b>
<b>50 sec &lt;= TCP download time</b>	<b>10%</b>	<b>3.30</b>	<b>2.98</b>

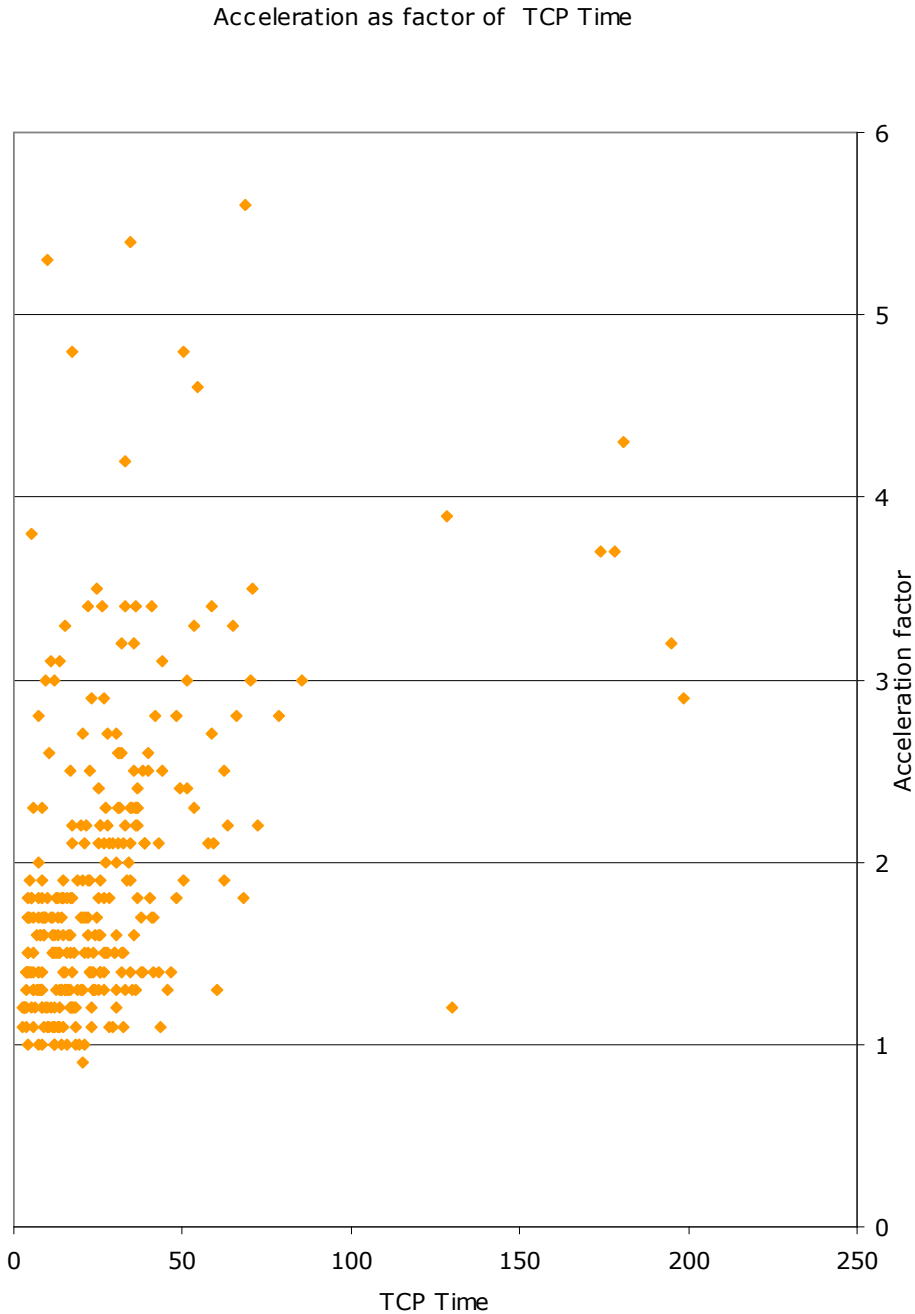
**TABLE 2 – ACCELERATION FACTORS VS. TCP DOWNLOAD TIMES**

<i>Subgroup</i>	<i>Highest Acceleration Factor</i>
<i>TCP download time &lt; 5 sec</i>	<i>1.94</i>
<i>5 sec &lt;= TCP download time &lt; 10 sec</i>	<i>5.26</i>
<i>10 sec &lt;= TCP download time &lt; 20 sec</i>	<i>4.80</i>
<i>20 sec &lt;= TCP download time &lt; 30 sec</i>	<i>3.47</i>
<i>30 sec &lt;= TCP download time &lt; 40 sec</i>	<i>5.36</i>
<i>40 sec &lt;= TCP download time &lt; 50 sec</i>	<i>3.38</i>
<i>50 sec &lt;= TCP download time</i>	<i>9.78</i>

**TABLE 3 – MAX ACCELERATION FACTORS FOR EACH TCP TIME SUBGROUP**

## 2.3 Download Time to Acceleration Correlation

To analyze the acceleration factors (see above), a spearman correlation test was performed between the TCP download time of a site and its generated acceleration factor.



**FIGURE 3 – ACCELERATION AS FACTOR OF TCP TIME**

As in previous tests, there is a strong correlation between the TCP download time and the Acceleration factor. ( $r=0.51$ ,  $p<0.001$ )

## 2.4 Data Savings

Data savings are measured according to the following formula:

$$\text{Saving} = 1 - (\text{Optimized Data in Bytes} / \text{Unoptimized Data in Bytes})$$

All data savings are given in percentage, and represent the amount of Bytes that are NOT sent over the network when the Flash Networks Data Optimization is integrated.

<i>List</i>	<i>Uplink Savings (%)</i>		<i>Downlink Savings (%)</i>	
<b>Subgroup</b>	Average	Median	Average	Median
TCP download time < 5 sec	5%	1%	4%	7%
5 sec <= TCP download time < 10 sec	22%	29%	11%	18%
10 sec <= TCP download time < 20 sec	23%	22%	5%	9%
20 sec <= TCP download time < 30 sec	23%	24%	2%	5%
30 sec <= TCP download time < 40 sec	25%	29%	14%	13%
40 sec <= TCP download time < 50 sec	20%	23%	4%	9%
50 sec <= TCP download time	22%	23%	6%	10%

**TABLE 5 – DATA SAVING FOR EACH TCP TIME SUBGROUP**