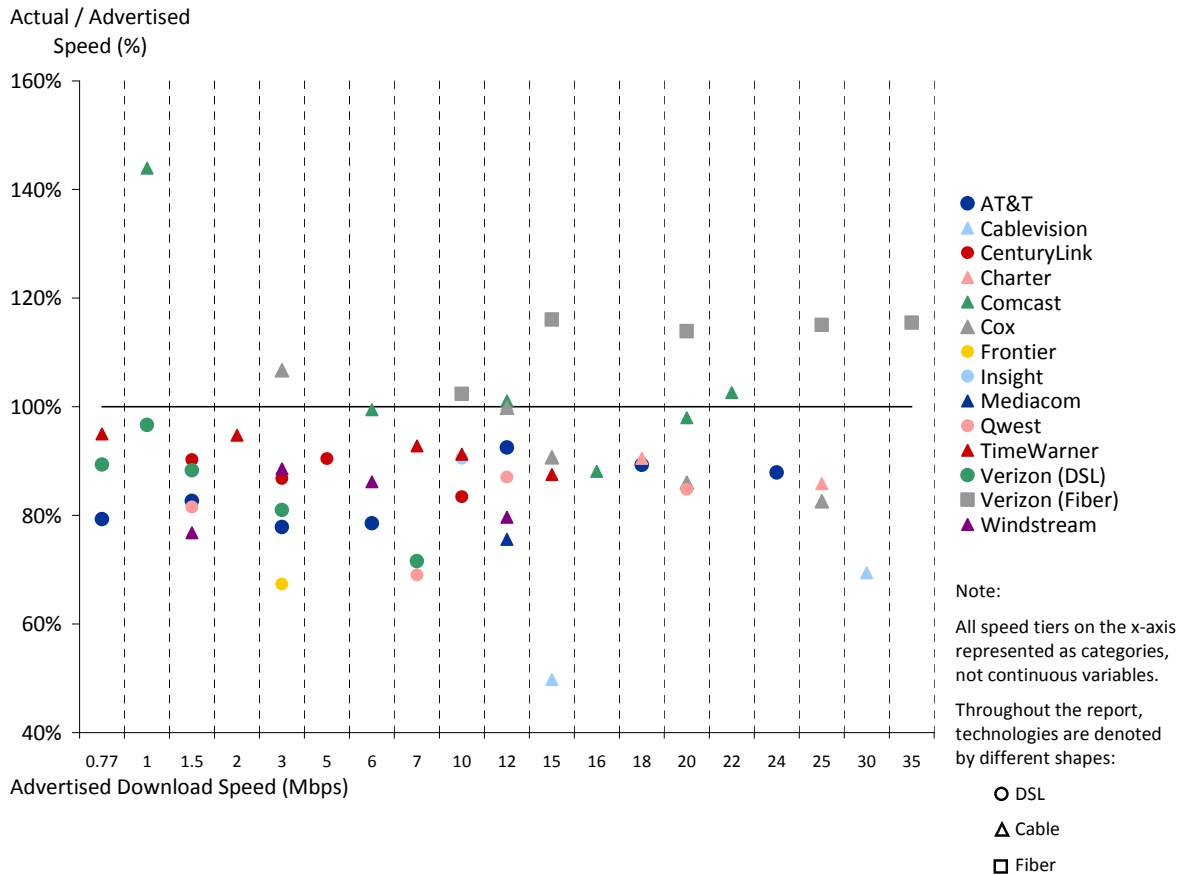


PERFORMANCE VARIATION BY SERVICE TIER

Download Peak Period Throughput

As shown in Chart 5, peak period performance varies by service tier among ISPs included in this study. Even during peak periods, the vast majority of service tiers offer performance levels approximately 80 percent or more of advertised speeds.<sup>38</sup> Fiber-to-the-home services typically outperform other service tiers, offering performance levels approximately 115 percent of advertised rates during peak periods. Other ISPs are either close to or exceed advertised rates.

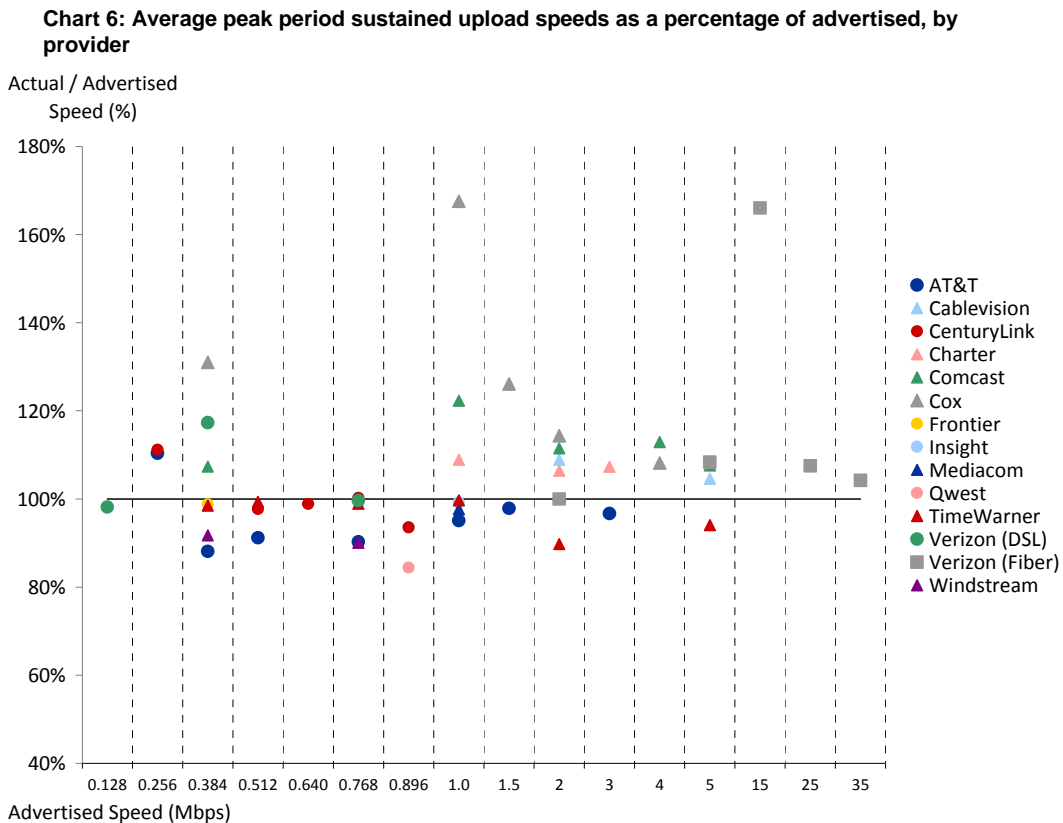
Chart 5: Average peak period sustained download speeds as a percentage of advertised, by provider



### Upload Peak Period Throughput

With the exception of some fiber-to-the-home service offerings, consumer broadband services are typically offered with asymmetric download and upload rates, with the download rate typically many times faster than the upload rate.

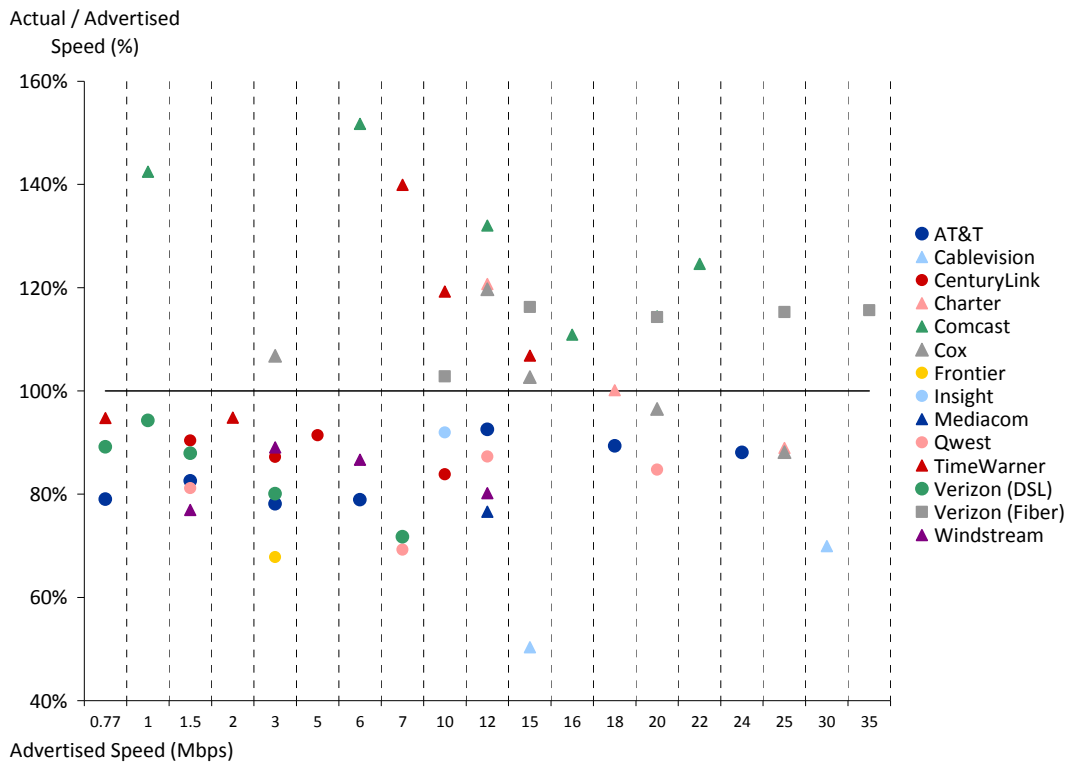
In general, the ratio of actual to advertised speed for upload performance is slightly superior to the ratio measured for download performance. Fiber-to-the-home services outperform cable and DSL in upload throughput, with many of the current services available on the market operating at symmetric speeds or speeds that are much closer to symmetric than those offered by their DSL and cable counterparts. On average, all technologies and speed bands deliver at least 84 percent of the advertised upload rate. Many cable service tiers exceed 100 percent of the advertised upstream rate. As with the downstream throughput results, fiber-to-the-home services continually deliver over 100 percent of the advertised upload speeds.

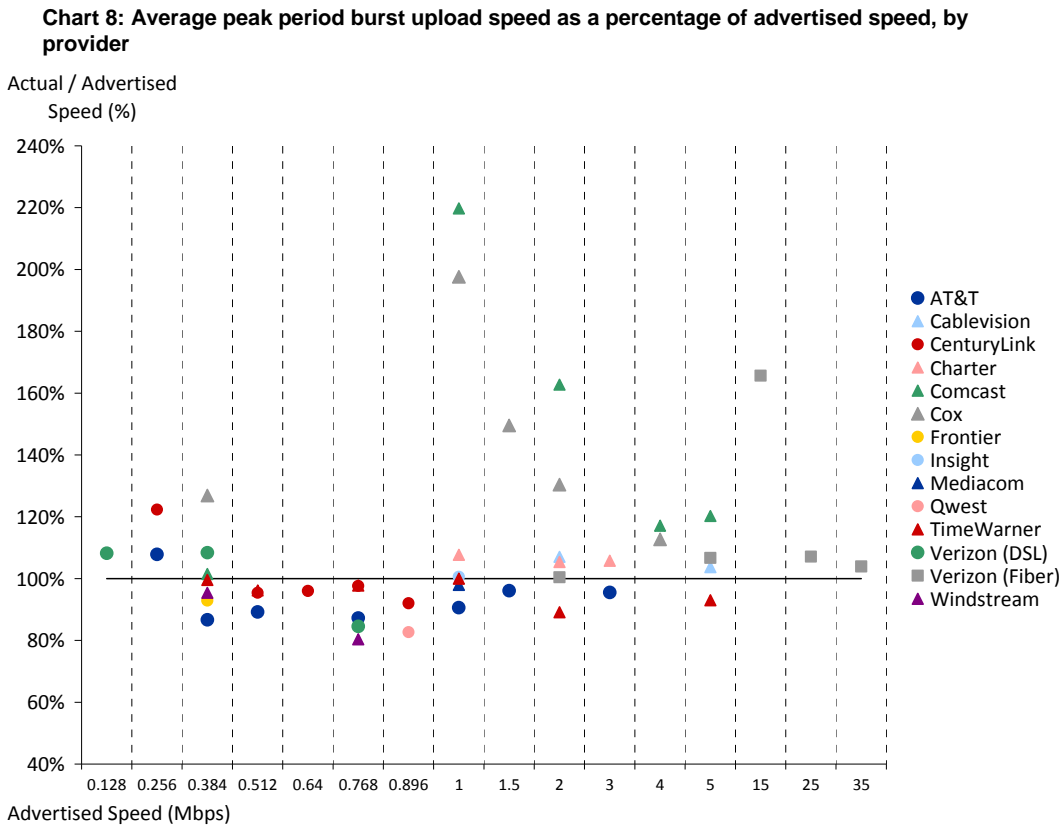


### Burst Versus Sustained Download Throughput

Comparing burst download speeds versus advertised speeds demonstrates the effect that burst services such as PowerBoost have on data throughput. For DSL- and fiber-to-the-home services, which do not, in general, employ boost technologies, there are no significant differences between sustained and burst measurements. As can be seen in Chart 7, in contrast, cable services employing boost technology consistently exceed 100 percent of advertised speeds across all speed tiers in which they are offered, achieving as high as 152 percent of advertised speed for one service. Chart 7 also shows that the effectiveness of burst technology varies among cable ISPs.

**Chart 7: Average peak period burst download speeds as a percentage of advertised speed, by provider**





The use of transient performance boosting features such as PowerBoost is less prevalent for upstream connections. The test results found marked improvement in burst upload speeds on some but not all service tiers, suggesting that PowerBoost might be applied to upstream performance by at least one or more ISPs. For example, in Chart 8, Cox and Comcast achieve average rates in the range of 130 percent to over 200 percent in service tiers ranging from 1 Mbps to 2 Mbps.

## Latency

As can be seen from Chart 9,<sup>39</sup> latency varies by technology and by service tier.<sup>40</sup> Fiber-to-the-home has the best performance in terms of latency, with a 17 ms average during the peak period, cable averages 28 ms, and DSL averages 44 ms and ranges as high as approximately 75 ms.<sup>41</sup> Although the test results found variance in latencies among technologies, all of the latencies measured here should be adequate for common Internet applications such as VoIP.

**Chart 9: Average peak period latency in milliseconds, by technology**

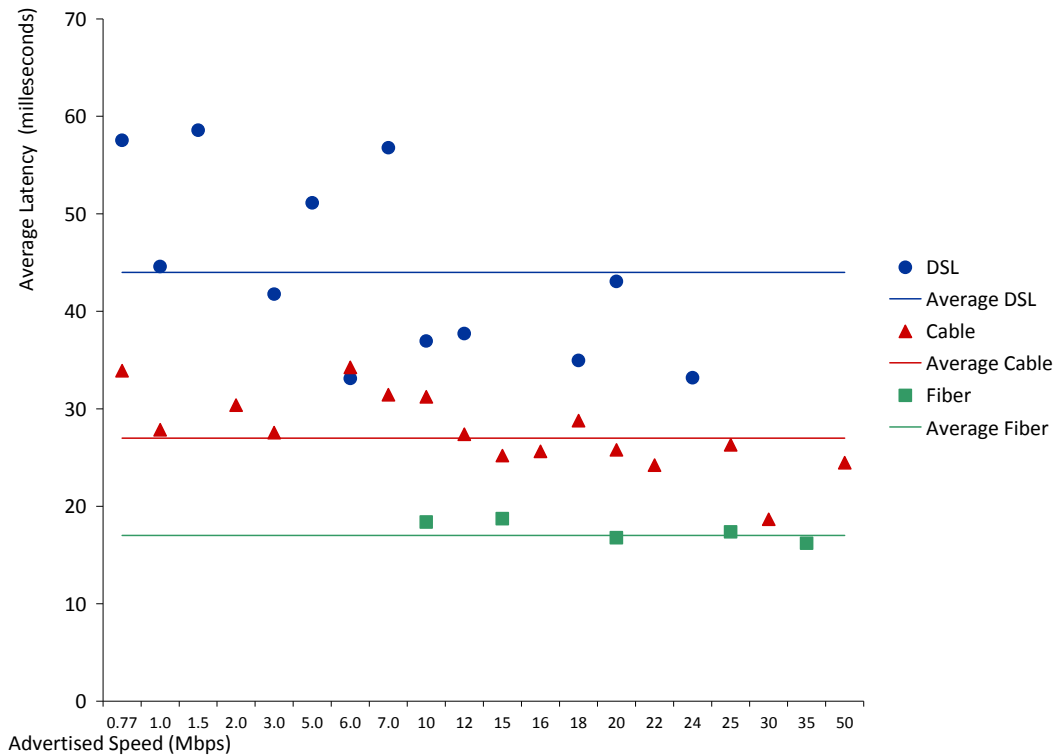


Chart 10 displays average web page loading<sup>42</sup> time by speed tier. Web pages load much faster as broadband speed increases, but beyond 10 Mbps, performance increases for basic web browsing are slight. The data indicate that a consumer subscribing to a 10 Mbps speed tier is unlikely to experience a significant performance increase in basic web browsing—*i.e.*, accessing web pages, but not streaming video or using other high-bandwidth applications such as video chat—by moving to a higher speed tier.

**Chart 10: Web loading time by advertised speed, by technology**

