



Telecom Regulatory Policy CRTC 2019-42

PDF version

Reference: 2018-242

Ottawa, 12 February 2019

Public record: 1011-NOC2018-0242

Establishment of an appropriate quality of service metric for jitter to define high-quality fixed broadband Internet access service

The Commission determines that to define fixed broadband Internet access service as a high-quality service, it must meet, among other things, a jitter threshold of 5 milliseconds, measured using specific predefined methodology. This further defines the broadband portion of the universal service objective.

Background

1. In Telecom Regulatory Policy 2016-496, the Commission determined that the availability of fixed broadband Internet access service offerings that meet certain quality of service (QoS) levels related to latency,¹ packet loss,² and jitter³ will help ensure that Canadians receive services that meet their needs and enable them to participate in the digital economy. The Commission stated that it expected that these QoS metrics would reflect the objective that broadband Internet access services in rural and remote areas be of similar high quality as those in urban areas.
2. In Telecom Decision 2018-241, the Commission determined, based on the CRTC Interconnection Steering Committee (CISC) Network Working Group's [NTRE061 report](#) (hereafter, the NTWG report), that to meet the broadband portion of the universal service objective, fixed broadband Internet access service is defined as a high-quality service if it provides the subscriber with a smooth experience when using real-time QoS-critical applications.⁴ Specifically, the Commission established a round-trip latency threshold of 50 milliseconds (ms) and a packet loss threshold of 0.25%, both based on measurement from the modem at the customer premises to a

¹ Latency refers to the time it takes for data packets to travel from a source to a destination. Latency is usually measured in terms of the round trip, i.e. from a source to a destination and back to the source.

² Packet loss refers to the number of data packets that are sent from a source that fail to reach their intended destination.

³ Jitter refers to the variation in latency that causes data packets that were sent at regular intervals from a source to arrive at a destination at irregular intervals. A high level of jitter may cause visible effects on real-time online applications, such as video pixilation, sound distortion, application "freezing," and delays in loading Web pages.

⁴ Based on the NTWG report, examples of QoS-critical applications are multi-player interactive games and cloud-based applications.

server located off-net⁵ at the Internet exchange point⁶ in a Canadian Tier 1 city⁷ during peak times (i.e. from 7 p.m. to 11 p.m. local time on weekdays).

Telecom Notice of Consultation 2018-242

3. In Telecom Decision 2018-241, the Commission determined that it was necessary and important to establish a QoS threshold for jitter, but that there was insufficient data on the record of that proceeding to determine such a threshold. The Commission therefore launched Telecom Notice of Consultation 2018-242 to define an appropriate jitter metric.
4. The Commission also determined that to ensure consistency with the established latency and packet loss QoS thresholds, the jitter threshold to define high-quality fixed broadband Internet access service must be based on the ability to support QoS-critical applications, as well as jitter performance measured during peak times and from the modem at the customer premises to a server located off-net at the Internet exchange point in a Canadian Tier 1 city.
5. The Commission received interventions and/or responses to requests for information from Bell Canada; Bragg Communications Incorporated, carrying on business as Eastlink (Eastlink); the Canadian Network Operators Consortium Inc. (CNOC); Cogeco Communications Inc. (Cogeco); Quebecor Media Inc., on behalf of Videotron Ltd. (Videotron); Rogers Communications Canada Inc. (RCCI); Shaw Communications Inc. (Shaw); TELUS Communications Inc. (TCI); and Xplornet Communications Inc. (Xplornet); as well as Hyman Glustein and Dr. Fenwick McKelvey (Glustein/McKelvey).

What should be the threshold for jitter to define high-quality fixed broadband Internet access service?

Positions of parties

6. Glustein/McKelvey stated that the establishment of QoS thresholds for broadband Internet access services, including a jitter threshold, is an important public interest issue.
7. Shaw proposed a jitter threshold of greater than 5 ms based on its broadband performance measurements, which it provided in confidence. RCCI also provided actual jitter measurements from its network in confidence but did not propose a jitter threshold. In the NTWG report, the Independent Telecommunications Providers Association also proposed a threshold of 5 ms.

⁵ This refers to a location at an Internet exchange point that marks the end of an Internet service provider's (ISP) network. Since this location is outside the ISP's network, it is referred to as being "off-net."

⁶ The Internet exchange point is where multiple ISPs connect to exchange Internet traffic with other ISPs in Canada and with the global Internet.

⁷ The current Tier 1 cities, based on the consensus recommendation in the NTWG report, are Calgary, Edmonton, Halifax, Moncton, Montréal, Ottawa, Saskatoon, Toronto, Vancouver, and Winnipeg.

8. Xplornet submitted that the average measured jitter value in its Canadian network from locations in Alberta, New Brunswick, Ontario, and Saskatchewan to a single Tier 1 city (Toronto) was between 10 and 21 ms for its fixed wireless service and 62 ms for its broadband satellite network.
9. Bell Canada, CNOC, Cogeco, Shaw, and Videotron all submitted that they did not have any data, conclusive studies, or industry standards that they could rely upon in recommending a jitter threshold for QoS-critical applications. Bell Canada, Cogeco, Eastlink, TCI, and Videotron confirmed that they do not have any data regarding jitter resulting from the Commission's [Broadband Measurement Project](#).
10. Videotron referred to an [Ofcom report](#)⁸ that indicated that for broadband service speeds of up to 50 megabits per second (Mbps), the average jitter measured in the United Kingdom was below 5 ms. This report also indicated that a high jitter level for fixed broadband Internet access services has a detrimental effect on the quality of experience of QoS-critical applications. As well, it noted that if a broadband service connection has a high jitter rate, low latency alone does not enable the provision of a high quality of broadband service to end-users.
11. Bell Canada, CNOC, TCI, and Videotron submitted that due to the lack of information regarding a jitter threshold for QoS-critical applications, the Commission should instead use a threshold of 30 ms for QoS-sensitive applications⁹ to define high-quality fixed broadband Internet access service. These parties indicated that this threshold is the upper limit for jitter required to support voice and video conferencing applications, since these applications are more sensitive than others to poor-quality connections. Bell Canada noted that the 30 ms jitter threshold should trigger a review of the communications network's performance, since end-users may experience a poor quality of service.
12. Bell Canada, Cogeco, RCCI, Shaw, TCI, Videotron, and Xplornet submitted that establishing a jitter threshold is not necessary to meet the broadband portion of the universal service objective. Cogeco and RCCI argued that thresholds for speed, latency, and packet loss are sufficient, since excessive jitter would be reflected in additional latency or packet loss. TCI and Videotron stated that many applications that are sensitive to jitter are equipped with buffers that neutralize its effect, reducing the need to control jitter in the network.
13. Bell Canada noted that there is a limit to how much buffering can be done for QoS-critical and QoS-sensitive applications, since buffering causes delays in communication. TCI submitted that some QoS-critical applications can be sensitive to high levels of latency and jitter in combination, and that improvements in broadband service performance frequently improve both latency and jitter.

⁸ *UK fixed-line broadband performance: The performance of fixed-line broadband delivered to UK residential customers*, May 2011

⁹ Based on the NTWG report, examples of QoS-sensitive applications are conversational voice applications, conversational video applications, and Web browsing.

14. Xplornet, supported by Bell Canada, was of the view that fixed wireless and direct-to-home satellite services should not be subject to the same urban QoS thresholds as fibre/coaxial- and fibre-based last mile solutions. Xplornet stated that if a jitter threshold must be adopted, it should be 80 ms, based on end-users' quality of experience for real-time video conferencing.

Commission's analysis and determinations

15. A high level of jitter can cause visible and audible effects, which negatively impact end-users' experiences, such as video pixilation, sound distortion, or delays in loading Web pages. The evidence on the record of this proceeding indicates that if a broadband service connection has a high jitter rate, low latency alone or the ability of applications to use buffering will not enable the provision of a high quality of broadband service to end-users. There is a limit to how much buffering can be applied to QoS-critical applications before delays due to buffering start negatively affecting a broadband user's experience. Consequently, and as the Commission determined in Telecom Regulatory Policy 2016-496, a jitter QoS threshold, in addition to latency and packet loss thresholds, is required to ensure that end-users receive a high quality of fixed broadband Internet access service.
16. In Telecom Decision 2018-241, the Commission defined high-quality fixed broadband Internet access service as one that provides the subscriber with a smooth experience when using real-time QoS-critical applications. On this basis, the Commission established the 50 ms latency and 0.25% packet loss QoS thresholds, and determined that the jitter threshold is to be established using the same approach.
17. Regarding the submission by Bell Canada, CNO, TCI, and Videotron to establish a jitter threshold based on QoS-sensitive applications, the Commission considers that use of such a threshold would not be consistent with the Commission's determinations in Telecom Regulatory Policy 2016-496 and Telecom Decision 2018-241, and as such would not define a high-quality fixed broadband Internet access service.
18. The proposed 30 ms jitter threshold is based on the lowest level of jitter required to support QoS-sensitive applications, at which broadband service starts to become of poor quality. Setting the jitter threshold at a level where poor quality broadband service is considered to begin was neither the purpose nor the Commission's intent in this proceeding. The purpose was to set the jitter threshold at a level that defines high-quality fixed broadband Internet access service based on the ability to support QoS-critical applications.
19. While some telecommunications service providers (TSPs) expressed support for the 30 ms threshold, no empirical evidence supporting the appropriateness of this metric was provided. The 30 ms threshold runs contrary to the jitter measurements that were provided by some TSPs from their fixed broadband Internet access networks, which were significantly below the 30 ms threshold and in fact closer to 5 ms.
20. With respect to Xplornet's position that fixed wireless and direct-to-home satellite services should not be subject to the same urban QoS thresholds as fibre/coaxial- and

fibre-based last mile solutions, the Commission stated in Telecom Regulatory Policy 2016-496 that it expected that the QoS metrics would reflect the objective that fixed broadband Internet access services in rural and remote areas be of similar high quality as those in urban areas. Consequently, the establishment of a lower QoS threshold for certain technologies or areas to define a high-quality fixed broadband Internet access service would run counter to achieving this objective.

21. In addition, the measurements that Xplornet provided are not consistent with the Commission's measurement methodology since they are not based on measurement to the nearest Internet exchange point in a Canadian Tier 1 city but rather from locations across the country to Internet exchange points in Toronto.
22. Shaw's proposal of greater than 5 ms for QoS-critical applications was based on measurements in its network. The Commission notes that QoS measurements conducted in the United Kingdom for broadband service speeds of up to 50 Mbps, using the same methodology as that defined by the Commission, show an average jitter level below 5 ms.¹⁰
23. Accordingly, the Commission considers that 5 ms is an appropriate jitter threshold to support QoS-critical applications and define high-quality fixed broadband Internet access service to meet the broadband portion of the universal service objective.
24. In light of all the above, the Commission sets a threshold for jitter of 5 ms to define high-quality fixed broadband Internet access service to meet the broadband portion of the universal service objective. As previously determined, this threshold would be measured during peak times (i.e. from 7 p.m. to 11 p.m. local time on weekdays), and from the modem at the customer premises to a server located off-net at the Internet exchange point in a Canadian Tier 1 city.

Secretary General

Related documents

- *Call for comments – Establishment of an appropriate quality of service metric for jitter to define high-quality fixed broadband Internet access service*, Telecom Notice of Consultation CRTC 2018-242, 13 July 2018
- *CISC Network Working Group – Non-consensus report on quality of service metrics to define high-quality fixed broadband Internet access service*, Telecom Decision CRTC 2018-241, 13 July 2018; as amended by Telecom Decision CRTC 2018-241-1, 3 August 2018
- *Modern telecommunications services – The path forward for Canada's digital economy*, Telecom Regulatory Policy CRTC 2016-496, 21 December 2016

¹⁰ This is also consistent with jitter measurements taken in the United States by the Federal Communications Commission and based on the same methodology as that determined by the Commission, which show the average jitter for a 50 Mbps broadband service across all technologies to be less than 5 ms.