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Conseil de la radiodiffusion et des télécommunications canadiennes

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Matters related to the reliability and resiliency of the 9-1-1 networks

Canadians rely on the continuous operation of 9-1-1 services to seek help during an emergency. Given the importance of 9-1-1 services to the health and safety of Canadians, the Commission conducted a public proceeding to examine a number of relevant issues.

Overall, the 9-1-1 networks in Canada are reliable and resilient. As a result, very few 9-1-1 service outages that impact the delivery of 9-1-1 voice calls have occurred over the last five years. Therefore, the Commission will not establish prescriptive regulatory measures but, instead, ***directs*** *9-1-1 network providers to take all reasonable measures to ensure that their 9-1-1 networks are reliable and resilient to the maximum extent feasible, and establishes certain notification and reporting requirements.*

Regarding concerns raised about MTS Inc.'s (MTS) 9-1-1 service backup solution, the Commission ***directs*** *MTS and interconnecting telephone service providers in Manitoba to work together to establish interconnection arrangements with MTS's backup solution.*

Background

1. Effective access to emergency services is critical to the health and safety of citizens, and is an important part of the Commission's role in ensuring that Canadians have access to a world-class communication system.[1] Canadians have come to rely on the continuous operation of 9-1-1 services to seek help during an emergency.

2. Canadians have access to either Basic or Enhanced 9-1-1 service[2] in areas where 9-1-1 call centres, also known as public safety answering points (PSAPs), have been established by provincial, territorial, or municipal governments.

[1] For more information on the Commission's role with respect to 9-1-1 services, refer to the "9-1-1 Services" page of the Commission's website at www.crtc.gc.ca.

[2] Basic 9-1-1 service enables callers to be connected to 9-1-1 operators in specialized 9-1-1 call centres, also known as public safety answering points (PSAPs), who dispatch the appropriate emergency responders. Enhanced 9-1-1 service includes Basic 9-1-1 service, but also automatically provides PSAP 9-1-1 operators with the telephone number and estimated location of the caller.

3. Incumbent local exchange carriers have established specialized 9-1-1 networks within their serving territories that provide enhanced functionality, increased reliability and resiliency, and a reduced risk of congestion for 9-1-1 calls. These 9-1-1 networks comprise the components and transmission facilities required to route 9-1-1 calls and ancillary information[3] from the telephone service provider (TSP)[4] to the appropriate PSAP.

4. When 9-1-1 calls are made in Canada today, they are transmitted first through the traditional wireline, wireless, or voice over Internet Protocol (VoIP) networks (known as the originating networks) of the TSPs that are Canadian carriers (TSP carriers). The originating networks are interconnected to the 9-1-1 network in a given serving territory. Based on the 9-1-1 caller's location,[5] the 9-1-1 call is routed through the 9-1-1 network to the PSAP that serves that location, along with the caller's ancillary information. The 9-1-1 operator in the PSAP then answers the call, determines the nature of the emergency, and dispatches the appropriate emergency responders (e.g. police, fire, or emergency medical services).

Regulatory framework

5. The provision of 9-1-1 services throughout Canada is complex and requires coordination between various parties, including TSPs; 9-1-1 network providers;[6] and the provincial, territorial, and municipal governments, which are responsible for emergency responders, and for the establishment and management of the PSAPs that dispatch these responders.

6. The Commission requires TSPs to provide Canadians who subscribe to local telephone services with access to 9-1-1 services wherever a local PSAP has been established. Specifically, each TSP must ensure that when a subscriber dials 9-1-1, the call is routed to the appropriate PSAP.

Proceeding

7. In Telecom Regulatory Policy 2014-342, which sets out the Commission's 9-1-1 action plan, the Commission indicated that it would review the reliability and resiliency of the 9-1-1 networks, including notification to 9-1-1 call centres of network outages that may affect them.

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[3] This information includes the caller's name, telephone number, and estimated location.

[4] TSPs include traditional wireline, wireless, and local voice over Internet Protocol (VoIP) service providers.

[5] For traditional wireline and fixed VoIP services, this location is identified in the Automatic Location Identification (ALI) database, which forms part of the 9-1-1 network. Wireless callers' locations are estimated through a combination of network triangulation calculations, network assisted-Global Positioning System (A-GPS), and other technologies. 9-1-1 calls made through nomadic VoIP services are first routed to a call taker in a third-party call centre, to whom the caller verbally relays their location, and the call taker subsequently transfers the call to the primary PSAP that serves that location.

[6] A TSP carrier that operates any or all elements of a 9-1-1 network is referred to as a 9-1-1 network provider.

8. Subsequently, the Commission published Telecom Notice of Consultation 2015-305 (the Notice), through which it sought to examine a number of issues relevant to the reliability and resiliency of the 9-1-1 networks.

9. The Commission's overall objective in this proceeding was to ensure that 9-1-1 network providers take reasonable measures for their 9-1-1 networks to be reliable and resilient, to the maximum extent feasible. Accordingly, the Commission sought to achieve the following goals:

    - minimize the possibility of 9-1-1 calls not being delivered to PSAPs due to 9-1-1 network outages;
    - strive for nationally consistent levels of 9-1-1 network reliability and resiliency while recognizing geographical diversity and the uniqueness of the 9-1-1 networks;
    - encourage continued innovation and investment in high-quality telecommunications facilities; and
    - implement regulatory measures that are proportionate to their purpose, efficient, effective, flexible, and technologically neutral.

10. The Commission received interventions and/or responses to requests for information from Bell Canada, CityWest Telephone Corporation (CityWest), MTS Inc. (MTS), Saskatchewan Telecommunications (SaskTel), and TELUS Communications Company (TCC) [collectively, the 9-1-1 network providers]; Bragg Communications Incorporated, operating as Eastlink (Eastlink), the Canadian Network Operators Consortium Inc., Quebecor Media Inc. (QMI), Rogers Communications Partnership (RCP), Shaw Communications Inc. (Shaw), and Westman Media Cooperative Ltd. (Westman) [collectively, the TSPs]; the City of Calgary 9-1-1 (Calgary), the Coalition pour le service 9-1-1 au Québec (Coalition), as well as the Conseil provincial du secteur municipal, the Canadian Union of Public Employees, and the Conseil provincial du secteur des communications (collectively, CPSM et al.), Emergency Communications for Southwest British Columbia (E-Comm), and the Royal Canadian Mounted Police (RCMP) [collectively, the PSAPs]; the Deaf Wireless Canada Committee; the Ontario Ministry of Health and Long-Term Care; the Province of British Columbia; the Public Interest Advocacy Centre (PIAC); and TBayTel.

11. The public record of this proceeding, which closed on 8 December 2015, is available on the Commission's website at www.crtc.gc.ca or by using the file number provided above.

Issues

12. The Commission has identified the following issues to be addressed in this decision:

- What is an appropriate definition for a 9-1-1 network?
- Is it appropriate for the Commission to impose regulatory measures regarding the reliability and resiliency of the 9-1-1 networks?
- Should the Commission intervene with respect to MTS's backup solution (Centrex)?
- Are 9-1-1 service outage notifications necessary?
- Should the Commission implement quality of service standards or service level agreements?
- Other matters

What is an appropriate definition for a 9-1-1 network?

13. The 9-1-1 networks comprise the components and transmission facilities required to route 9-1-1 calls and ancillary information from the TSP carriers' originating networks to the appropriate PSAP. The Commission's focus in this proceeding is on the reliability and resiliency of the 9-1-1 networks, and not on that of the originating networks or of the PSAPs themselves. In paragraph 20 of the Notice, the Commission presented a list of components and transmission facilities that it considered to be part of a 9-1-1 network, and invited views on whether the list was representative and comprehensive.

Positions of parties

14. The TSPs were generally of the view that a 9-1-1 network should begin at the point of interconnection between the originating networks and the 9-1-1 network, and end at the demarcation point between the 9-1-1 network and the PSAPs.

15. The Coalition and E-Comm considered the TSP carriers' originating networks to be part of the 9-1-1 network. TCC considered the 9-1-1 voice trunks (or equivalent voice lines), dedicated or otherwise, including the point of interconnection with TSP carriers to the 9-1-1 primary and secondary tandems, to be part of the TSP carriers' originating networks and therefore outside the Commission's defined scope for this proceeding.

16. Bell Canada submitted that (i) the portion of the Automatic Location Identification (ALI) service that TSP carriers use to update subscriber information should be excluded, since it is not critical for the delivery of a 9-1-1 call; (ii) since the ALI service resides on the company's Emergency Routing Service platform, the Emergency Routing Service would be a more appropriate component of the 9-1-1 network; (iii) the 9-1-1 network monitoring links should be excluded since they are part of a monitoring tool for all aspects of the company's network (i.e. these links are

not dedicated to the 9-1-1 service); (iv) Text with 9-1-1 is a common gateway shared among all 9-1-1 network providers (i.e. it is not particular to any 9-1-1 network); (v) the Text with 9-1-1 gateway is connected to the PSAPs via a virtual path on its Internet Protocol – Multiprotocol Label Switching (IP-MPLS) network and uses the same 9-1-1 data links that are used to connect the ALI database to the PSAP's demarcation point; and (vi) the transmission facilities (i.e. 9-1-1 data links) connecting its 9-1-1 network to the Text with 9-1-1 gateway vendor's points of interconnection are considered to be part of its 9-1-1 network.

17. MTS submitted that its 9-1-1 network includes components that connect primary and secondary PSAPs,[7] as well as the Centrex service, which are used as a disaster recovery solution to route 9-1-1 calls to PSAPs in the event of a tandem switch failure or another serious failure in the 9-1-1 network.

Commission's analysis and determinations

18. For the purpose of this decision, the Commission defines a 9-1-1 network as beginning at the point of interconnection between the originating networks and the 9-1-1 network, and ending at the demarcation point between the 9-1-1 network and the primary PSAPs. A list of the specific components and transmission facilities included in this definition is outlined in Appendix 1 to this decision. In finalizing this definition, the Commission considered the following:

    - The 9-1-1 voice trunks connecting the TSP carriers' originating networks up to the interconnection point with the 9-1-1 network are part of the originating networks and are therefore excluded from the definition. However, the point(s) of interconnection between the TSP carriers' originating networks and the 9-1-1 network form part of the 9-1-1 network and are included in the definition, as well as any 9-1-1 voice trunks (or equivalent voice lines) that may be used from the point of interconnection to the 9-1-1 primary and secondary tandems.
    - Certain modifications were made with respect to the ALI database and Text with 9-1-1 components of the 9-1-1 network to reflect the concerns raised by Bell Canada.
    - Network monitoring performed at an overall network level (i.e. monitoring that is not dedicated to 9-1-1 data links or trunks only) is outside the 9-1-1 network definition; therefore, the 9-1-1 network monitoring links have been excluded from the definition.[8]

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[7] A primary PSAP is a PSAP to which 9-1-1 calls are routed directly as the first point of contact for all 9-1-1 calls. The primary PSAP contacts the appropriate agency to dispatch the emergency response. In cases where local authorities determine that certain emergency responses require specialized expertise to handle the 9-1-1 call, such as emergency medical services, 9-1-1 calls are transferred to a secondary PSAP.

[8] However, network monitoring is a key part of the overall reliability and resiliency of the 9-1-1 networks since it allows for the quick detection of network performance issues and outages.

- Disaster recovery solutions, such as the use of Centrex service as a backup, form part of the 9-1-1 network, since they are used to route 9-1-1 calls through the 9-1-1 network provider to the appropriate PSAP in the event of certain types of 9-1-1 network failures.

- Only connections to primary PSAPs' demarcation point(s) [i.e. not connections between primary and secondary PSAPs] are in the scope of this proceeding because the Commission's primary goal is the delivery of 9-1-1 voice calls to the primary PSAP.

Is it appropriate for the Commission to impose regulatory measures regarding the reliability and resiliency of the 9-1-1 networks?

Positions of parties

19. The 9-1-1 network providers, the TSPs, and the PSAPs indicated that generally, the current 9-1-1 networks are reliable and resilient. The 9-1-1 network providers submitted that regulatory measures regarding the reliability and resiliency of the current 9-1-1 networks are not required, since Canadians already benefit from reliable and resilient 9-1-1 networks without the Commission's intervention.

20. Bell Canada indicated that the most critical reliability and resiliency goal is to ensure the continuity of 9-1-1 services despite any outages in parts of the 9-1-1 networks.

21. Bell Canada and MTS submitted that because their 9-1-1 networks are unique and complex, it is not possible or appropriate to establish specific or prescriptive requirements for all 9-1-1 network providers nationally.

22. Bell Canada submitted that 9-1-1 network providers already have strong incentives to ensure the reliability and resiliency of their 9-1-1 networks, since any 9-1-1 network outage would have significant, brand-damaging effects on the 9-1-1 network provider experiencing the outage. Bell Canada further submitted that contingency planning, coupled with proactive internal company reviews of equipment diversity and redundancy, are far more effective.

23. The 9-1-1 network providers and some of the TSPs submitted that given the upcoming transition from current 9-1-1 networks to Next-Generation 9-1-1 (NG9-1-1) networks,[9] any changes to voice network topology based on new regulatory measures would be short-lived and not an efficient or prudent use of limited resources.

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[9] Using Internet Protocol (IP) technology to replace current aging technology, NG9-1-1 services will provide callers with new ways to access emergency services from multiple devices and platforms. It is expected that in the future, Canadians will be able to interact with emergency service providers using text messaging, pictures, videos, or other means.

24. In contrast, PIAC and the PSAPs submitted that the Commission should establish regulatory measures as a precaution and to ensure national consistency in the reliability and resiliency of the 9-1-1 networks, given that 9-1-1 services are critical to the health and safety of Canadians.

Commission's analysis and determinations

25. Overall, the 9-1-1 networks in Canada are reliable and resilient. Even in the absence of Commission-imposed regulatory measures, 9-1-1 network providers have the willingness, capability, and expertise to design high-quality 9-1-1 networks. Over the last five years, very few 9-1-1 service outages have occurred that impact the delivery of 9-1-1 voice calls (i.e. fully service impacting outages), and no large-scale 9-1-1 network outages have occurred.

26. It is clear that (i) each 9-1-1 network has a unique architecture, (ii) 9-1-1 network providers use a wide variety of industry best practices that are appropriate to their particular circumstances, and (iii) 9-1-1 network providers have implemented a combination of strategies to mitigate the risk of 9-1-1 service disruptions (mitigating strategies) based on their network architectures, the PSAPs' requirements, the PSAPs' mitigating strategies,[10] and regional or geographical considerations.

27. The current 9-1-1 networks of Bell Canada, CityWest, SaskTel, and TCC generally meet the Commission's stated goal of minimizing the possibility of 9-1-1 calls not being delivered to PSAPs due to 9-1-1 network outages. Only one major reliability and resiliency issue was identified with respect to MTS's 9-1-1 network, which is discussed in the next section.

28. 9-1-1 network providers have submitted samples of their agreements with provincial, territorial, or municipal governments. Some 9-1-1 network providers are subject to certain contractual reliability and resiliency requirements, such as quality of service standards generally accepted in North America.[11] However, these requirements do not apply to all 9-1-1 network providers, indicating a lack of national consistency.

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[10] PSAPs can use a variety of mitigating strategies to ensure business continuity in the event of 9-1-1 network outages, PSAP outages, or other business disruptions, such as (i) having diverse entries for transmission facilities, such that if one transmission facility is cut, 9-1-1 calls can be routed through another one; (ii) having a backup location (also known as an evacuation location), also with diverse entries; and (iii) entering into agreements with other PSAPs to process 9-1-1 calls on each other's behalf should one PSAP be unable to do so, or should call volumes exceed the PSAP's capacity to process calls.

[11] Such requirements include an average of 0.1% blocking within the network, diverse telephone networking capabilities, and updated Automatic Number Identification (ANI) or ALI records in the 9-1-1 service provider's database.

29. In light of the above, it would not be appropriate or necessary to adopt prescriptive measures that would apply nationally to all 9-1-1 networks. However, a general obligation, with guidance as to how it will be interpreted for individual 9-1-1 networks, would enable the Commission to (i) address any complaints or issues raised regarding the reliability and resiliency of the 9-1-1 networks, and (ii) take compliance and enforcement actions if necessary. Such an approach would reflect the Commission's goals in a way that is proportionate to its purpose, efficient, effective, flexible, and technologically neutral, while ensuring that Canadians continue to benefit from reliable and resilient 9-1-1 networks as the networks transition to NG9-1-1.

30. Accordingly, the Commission **imposes** the following obligation as a condition pursuant to section 24 of the *Telecommunications Act* (the Act) on all carriers that are 9-1-1 network providers:

> *9-1-1 network providers must take all reasonable measures to ensure that their 9-1-1 networks (as defined[12]) are reliable and resilient to the maximum extent feasible.*

31. To assist parties in interpreting what measures would be reasonable with respect to their individual networks, 9-1-1 network providers should use an adequate combination of industry best practices that should generally include the following:

- 9-1-1 network design principles,[13] e.g. critical component backups configured in a geo-redundant fashion, diverse interconnections from originating networks to the 9-1-1 networks (including backup solutions), location (or site) diversity, transport network diversity (i.e. physically diverse routes with no single points of failure), network available 99.999% of the time, minimum P.01 voice trunk grade of service,[14] and backup power provisions lasting a minimum of 24 hours for central office switches and 72 hours for tandem switches;

- 9-1-1 operation and maintenance practices (e.g. route diversity auditing or a change management process to protect route diversity);

- contingency plans for disaster or outage recovery of 9-1-1 networks to minimize, to the extent feasible, the likelihood and duration of unforeseen, service-impacting 9-1-1 network outages (i.e. 9-1-1 network outages that result in 9-1-1 calls not being delivered to the appropriate PSAP); and

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[12] Refer to Appendix 1 to this decision for a list of the components and transmission facilities that comprise a 9-1-1 network.

[13] Refer to Appendix 2 to this decision for an explanation of some of these principles.

[14] The generally accepted North American 9-1-1 standard for trunk capacity provisioning is such that the probability of a blocked call is 1 in 100 during the busiest hour.

- 24/7 monitoring of 9-1-1 networks such that 9-1-1 network performance issues, including outages, are quickly detected and resolved.

32. The Commission will address any complaints or issues raised regarding the reliability and resiliency of a particular 9-1-1 network on a case-by-case basis, and take enforcement actions if required.

33. The Commission encourages PSAPs to implement mitigating strategies of their own to improve the reliability and resiliency of their infrastructure and procedures, such as providing 9-1-1 network providers physically diverse entries for 9-1-1 transmission facilities into the PSAP building, having a backup (or evacuation) site with diverse entries, and having a call-handling arrangement with a partner PSAP to handle calls on each other's behalf during outages.

Should the Commission intervene with respect to MTS's backup solution (Centrex)?

Positions of parties

34. Shaw stated that concerns were raised by RCP and Westman in a separate proceeding[15] regarding MTS's current 9-1-1 network. RCP raised the same issue in this proceeding, and noted that the levels of geo-redundancy and resiliency of the 9-1-1 networks in Canada vary depending on the 9-1-1 network provider. Shaw indicated that it shared these concerns and wondered how MTS plans to resolve its 9-1-1 network interconnection issues.

35. MTS submitted that it has had very few issues with the reliability and resiliency of its current 9-1-1 network. MTS stated that it has implemented a Centrex-based backup solution in which 9-1-1 calls are re-routed in the case of a major component failure to ensure the continuity of 9-1-1 services, but that it has never needed to use this solution. MTS indicated that in the event of a failure requiring the use of the Centrex backup solution, it can take interconnecting TSP carriers up to several hours to re-route 9-1-1 calls to its Centrex backup solution, during which time 9-1-1 calls made by their subscribers are not delivered to PSAPs.

36. MTS stated that it has developed a comprehensive plan to upgrade its 9-1-1 network to support NG9-1-1 services, which will resolve the geo-redundancy issue in its 9-1-1 network. MTS submitted that it would connect TSP carriers to this new Internet Protocol (IP) network, and that the estimated time to complete this transition is approximately three years.

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[15] See MTS's Tariff Notice 766.

Commission's analysis and determinations

37. MTS has taken measures to implement a Centrex-based backup solution that mitigates the risk of any disruption in the provision of 9-1-1 services due to a failure of any major components of its primary 9-1-1 network. Given that these components have proven to be reliable, that they have never had a failure, and that a backup solution is in place, the likelihood of a 9-1-1 service disruption is very low.

38. However, MTS indicated that if its Centrex backup solution were to be used, it could take interconnecting TSP carriers up to several hours to re-route 9-1-1 calls, during which time, 9-1-1 calls made by their subscribers would not be delivered to PSAPs. The Commission considers this to be inconsistent with its goal of minimizing the possibility of 9-1-1 calls not being delivered to PSAPs due to 9-1-1 network outages. Therefore, intervention is appropriate.

39. In light of the above, the Commission **imposes** the following obligations:

    *(i) TSP carriers that interconnect with MTS's 9-1-1 network are required, by **2 August 2016**, to (a) establish interconnection arrangements with MTS, if they have not already done so, in a manner that enables them to quickly re-route their subscribers' 9-1-1 calls to MTS's Centrex backup solution, and (b) ensure that their subscribers' 9-1-1 calls are quickly re-routed to MTS's Centrex backup solution to minimize any potential disruption in 9-1-1 service during a switchover process.*

    *(ii) MTS is required, by **2 August 2016**, to provide interconnecting TSP carriers with (a) the appropriate points of interconnection to its Centrex backup solution so that 9-1-1 calls made on the TSP carriers' originating networks are delivered to the appropriate PSAPs in Manitoba, and (b) any information the TSP carriers need to implement arrangements in their originating networks to quickly re-route their subscribers' 9-1-1 calls to MTS's Centrex backup solution to minimize any disruption in 9-1-1 service.*

    *(iii) MTS is to confirm with the Commission that these arrangements are in place with all TSP carriers that interconnect with it in its serving territory by **30 August 2016**.*

Are 9-1-1 service outage notifications necessary?

40. During a 9-1-1 service outage, subscribers may be able to make normal telephone calls, but their 9-1-1 calls are not delivered to their local PSAP. 9-1-1 service outages are usually the result of a failure (i) in the 9-1-1 network (a 9-1-1 network outage), (ii) in the TSP carrier 9-1-1 voice trunks and/or data links used to route 9-1-1 calls and ancillary information (a TSP carrier 9-1-1 service outage), or (iii) within the PSAP (a PSAP outage).

41. While there are some industry-established guidelines for 9-1-1 network providers and TSP carriers to notify PSAPs during 9-1-1 service outages caused by issues in their networks, there are currently no Commission requirements for 9-1-1 network providers or TSP carriers to notify each other, PSAPs, and/or the Commission in the event of such outages.

Positions of parties

42. MTS submitted that notifications can provide value, but that it can be a challenge to balance timeliness against accuracy.

43. Bell Canada and SaskTel submitted that the Commission should not require affected parties to notify each other in the event of 9-1-1 service outages since there are currently internal notification processes in place.

44. TCC submitted that it did not oppose a requirement for 9-1-1 network providers to notify affected PSAPs and TSP carriers of 9-1-1 network outages, since these parties should obtain immediate notice of any 9-1-1 service outage that may affect their service areas.

45. Bell Canada, MTS, and TCC submitted that if the Commission decides to establish notification requirements, these requirements should be reviewed by the CRTC Interconnection Steering Committee (CISC) Emergency Services Working Group (ESWG) in order to take into account input from PSAPs, 9-1-1 network providers, and TSP carriers.

46. Calgary, the Coalition, CPSM et al., E-Comm, and PIAC submitted that the Commission should require 9-1-1 network providers and TSP carriers to notify each other, affected PSAPs, and the Commission of any circumstances that may affect 9-1-1 services or operations.

47. While Calgary and the Coalition submitted that the Commission should also encourage PSAPs to notify 9-1-1 network providers of all PSAP outages, CPSM et al. submitted that 9-1-1 network providers are already made aware in real time of these outages.

48. Eastlink, QMI, Shaw, and Westman submitted that 9-1-1 network providers should be required to notify TSP carriers and PSAPs of 9-1-1 network outages that would affect their ability to transfer 9-1-1 calls to PSAPs.

49. Westman submitted that notification of 9-1-1 service outages should be given once repair has been initiated. However, Shaw submitted that notification should occur immediately upon discovery of a critical failure in the 9-1-1 networks.

50. Eastlink, QMI, and Shaw submitted that TSP carriers should be required to notify PSAPs and 9-1-1 network providers only when both their primary and secondary 9-1-1 trunks fail. However, RCP submitted that TSP carriers' 9-1-1 trunks are already monitored by 9-1-1 network providers.

Commission's analysis and determinations

51. The overall goal of providing 9-1-1 service outage notifications is to ensure that (i) parties that are directly required to take action to restore service are able to do so quickly, and (ii) parties can inform the public of alternative measures to access emergency services if the time to repair the outage is lengthy.

52. All 9-1-1 network providers provide some level of notification to PSAPs when a 9-1-1 network outage occurs; however, there is no consistency amongst 9-1-1 network providers with respect to the type of outage that triggers notification, the parties that are notified (e.g. affected PSAPs and/or TSP carriers), or the time frame in which to provide these notifications. In addition, current notification processes may be incomplete.

53. If TSP carriers were notified of a 9-1-1 network outage that could affect the ability of their customers to reach 9-1-1 services, they could then inform their customers of the outage, where appropriate, and recommend alternative measures to access emergency services. No PSAPs and not all 9-1-1 network providers currently provide such notifications to TSP carriers.

54. Accordingly, given the critical nature of 9-1-1 services to the health and safety of citizens, the Commission has established requirements, as described below, for 9-1-1 service outage notification to ensure consistency throughout Canada and to enable the appropriate parties to ensure public safety.

Notification of 9-1-1 service outages to affected parties

55. The priority during an outage should be the restoration of 9-1-1 services. Therefore, 9-1-1 network providers, TSP carriers, and PSAPs that need to be directly involved in taking action to fix the outage or restore service should be notified immediately that they need to do so.

56. Regarding notification of 9-1-1 service outages for informational purposes, there is a need to balance the timeliness of providing such notification to parties that are affected by the outage but not directly involved in taking actions to fix it (i.e. affected parties, which refers to 9-1-1 network providers, TSP carriers, and/or PSAPs), with the usefulness of the information that can be provided.

57. For example, requiring 9-1-1 network providers or TSP carriers to provide notification for informational purposes immediately upon discovery of a 9-1-1 service outage may not lead to sufficient and accurate information being shared. Immediate notification would not allow sufficient time to diagnose the problem or to provide an estimated time frame to fix the problem. However, waiting to provide notification only after the cause of a 9-1-1 service outage is known may affect public safety.

58. Accordingly, notification for informational purposes should be provided within an established, consistent time frame, i.e. within a maximum of 30 minutes from the time the 9-1-1 service outage is discovered. This would provide an adequate balance between the timeliness of the notification and the usefulness of the information provided to affected parties.

59. In cases where 9-1-1 service outages are resolved before affected parties are notified, there is little value in notifying affected parties that an outage occurred. As such, 9-1-1 service outage notification for informational purposes should be given only for ongoing 9-1-1 service outages.

60. Based on these general principles, the scenarios in which it would be in the public interest to provide notification, and to whom, are described below.

Scenario 1 – 9-1-1 network outages that are not service impacting

61. Some 9-1-1 network outages are not detectable by PSAPs and telephone subscribers, for example, when there is a failure in a 9-1-1 voice trunk and the 9-1-1 calls are automatically re-routed and delivered through another voice trunk without any disruption in the ability to make 9-1-1 calls. It is therefore not appropriate or necessary to establish notification requirements for informational purposes in this scenario. If TSP carriers must take action to resolve the issue, then 9-1-1 network providers should notify the appropriate TSP carriers.

Scenario 2 – 9-1-1 service outages that are partially service impacting

62. Some 9-1-1 service outages may impact only the delivery of ancillary information while 9-1-1 voice calls continue to be delivered to PSAPs. Since PSAPs' operations are affected in this scenario, 9-1-1 network providers should provide notification, for informational purposes, to PSAPs affected by these types of ongoing 9-1-1 service outages within a maximum of 30 minutes from the time the outage is discovered in the 9-1-1 network. In addition, TSP carriers should notify 9-1-1 network providers, for informational purposes, within a maximum of 30 minutes of discovering an ongoing outage that impacts the delivery of ancillary information only.

Scenario 3 – 9-1-1 service outages that are fully service impacting

63. In cases of 9-1-1 network outages that prevent 9-1-1 voice calls from being delivered to PSAPs, for example, when the primary and backup 9-1-1 tandems have failed, notification should be given immediately to parties that need to be directly involved in restoring service. As well, 9-1-1 network providers should provide notification, for informational purposes, within a maximum of 30 minutes from the time this type of ongoing outage is discovered, to TSP carriers and PSAPs that are affected by such ongoing outages to help determine whether it would be appropriate to notify the public of the outage. 9-1-1 network providers should also notify TSP carriers and PSAPs when 9-1-1 services are restored.

64. Finally, if 9-1-1 calls are not delivered to PSAPs during a 9-1-1 service outage, 9-1-1 network providers should provide PSAPs with a report of the dropped 9-1-1 calls, if this information is available in a timely manner, to enable PSAPs to follow up with the 9-1-1 callers, as appropriate.

Conclusion

65. In light of the above, the Commission requests that the ESWG do the following:

- develop 9-1-1 service outage notification processes and mechanisms for 9-1-1 network providers and TSP carriers based on the principles and scenarios defined above, and
- report its recommendations to the Commission within **six months** of the date of this decision.

Notification of 9-1-1 service outages to the Commission

66. Given that the Commission is not directly involved in the resolution of 9-1-1 service outages, notification to the Commission is not a priority. Accordingly, the Commission does not require 9-1-1 network providers to notify it of any 9-1-1 service outages at the time they occur. However, it is appropriate for the Commission to monitor the reliability and resiliency of the 9-1-1 networks on an ongoing basis, as discussed in the "Reporting requirements" section below.

Notification of PSAP outages to 9-1-1 network providers, TSP carriers, and the Commission

67. It would be beneficial for affected 9-1-1 network providers and TSP carriers to be notified if 9-1-1 calls are not being answered by PSAPs, for example, when a major PSAP outage affects both the primary PSAP and its backup location. 9-1-1 network providers and TSP carriers could then inform their customers and recommend alternative measures to seek emergency assistance.

68. Accordingly, the Commission encourages PSAPs that are not in a position to answer 9-1-1 calls to notify 9-1-1 network providers and TSP carriers of a PSAP outage. The ESWG may choose to examine the appropriate mechanisms for such notification. However, the Commission need not be notified of PSAP outages since this information would not assist the Commission in monitoring the reliability and resiliency of the 9-1-1 networks.

Should the Commission implement quality of service standards or service level agreements?

69. Some 9-1-1 network providers, through their 9-1-1 agreements with provincial/territorial or municipal governments, are required to meet certain 9-1-1 quality of service (Q of S) standards that are generally accepted in North America. Some 9-1-1 network providers have also established service level agreements (SLAs) pertaining to the provision of 9-1-1 services.

70. The Commission has not, to date, imposed Q of S standards or required SLAs for the provision of 9-1-1 networks in Canada.

Positions of parties

71. The 9-1-1 network providers and TSP carriers that commented on the matter submitted that Q of S standards and/or SLAs are not necessary.

72. Bell Canada argued that there is no one set of Q of S standards or SLAs that would be universally appropriate for 9-1-1 networks, since it is unlikely that such standards and agreements could account for all potential outage incidents.

73. TCC submitted that SLAs have not been necessary to date, and that considerable work would be required to develop implementable standards.

74. SaskTel argued that there is no compelling evidence of 9-1-1 network deficiencies that would warrant the implementation of Q of S standards or SLAs.

75. Westman submitted that 9-1-1 network providers, TSP carriers, and PSAPs should have the option to establish SLAs if they find it appropriate, but that the Commission should not mandate SLAs.

76. While Calgary supported the establishment of SLAs between 9-1-1 network providers and PSAPs, arguing that these agreements provide clear and measurable expectations for each party, the Coalition indicated that it would prefer the implementation of regulatory obligations over contractual obligations. The Coalition argued that through regulatory obligations, if any problems occur, PSAPs would only have to file a complaint with the Commission rather than having to undertake lengthy legal procedures against sophisticated entities.

77. PIAC supported the creation of mandatory Q of S standards to establish a model to which the reliability and resiliency of 9-1-1 networks can be compared.

Commission's analysis and determinations

Quality of service standards

78. Since all 9-1-1 networks in Canada are unique, it would be complicated to develop national Q of S standards for 9-1-1 networks that would address the specific circumstances of every 9-1-1 network, especially given the fact that 9-1-1 network providers are currently working towards the migration of their 9-1-1 networks to NG9-1-1.

79. Further, the reliability and resiliency requirements established above, as well as the reporting requirements described below, are sufficient, at this time, to ensure that Canadians receive consistent, high-quality 9-1-1 services.

80. Accordingly, the Commission finds that no Q of S standards are required at this time for the provision of 9-1-1 networks.

Service level agreements

81. Since municipal governments may have different requirements on what to include in SLAs related to 9-1-1 services, it would be complicated to create national or provincial/territorial SLAs that would address all PSAPs' specific circumstances. Consequently, mandating SLAs between 9-1-1 network providers and municipal and provincial/territorial governments, even on a request-driven basis, would require the 9-1-1 network providers to negotiate unique agreements with numerous municipal governments.

82. In addition, parties did not provide any evidence to suggest that Commission-mandated SLAs are necessary at this time, and no party, including the PSAPs, provided evidence that they were not able to negotiate such agreements.

83. Accordingly, while it is not necessary for the Commission to mandate SLAs at this time for the provision of 9-1-1 networks, some parties may consider it appropriate to negotiate such agreements. As such, the Commission encourages 9-1-1 network providers to enter into discussions with PSAPs regarding SLAs, as appropriate.

Other matters

84. Parties to this proceeding, especially PSAPs, submitted other issues or proposed actions that the Commission could take regarding the provision of 9-1-1 services in Canada.[16] However, many of these issues are outside the scope of this proceeding. Accordingly, the Commission will address these issues as part of other proceedings, as appropriate. The two issues that would be appropriately addressed as part of this proceeding are discussed below.

Reporting requirements

85. The Commission does not currently have regulatory requirements for 9-1-1 network providers to report on 9-1-1 network outages or to provide it with periodic information pertaining to the management of their 9-1-1 networks. Some parties submitted that it would be appropriate to establish such requirements.

Positions of parties

86. Calgary submitted that 9-1-1 network providers should report on the monthly availability of their 9-1-1 networks to the Commission, arguing that this reporting would not be a significant burden on 9-1-1 network providers.

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[16] These issues include the Commission reviewing certain 9-1-1 service tariffs, monitoring European and American practices regarding emergency services, and reviewing the provision of Text with 9-1-1 in Canada.

87. The Coalition submitted that 9-1-1 network providers should be required to provide annual reports pertaining to their 9-1-1 networks when there are outages or network changes, and that such reports should be publicly available.

88. CPSM et al. submitted that the Commission should require 9-1-1 network providers to provide annual reports detailing their actions taken to verify the reliability of their 9-1-1 networks, or an annual attestation of compliance with any reliability and resiliency standards that the Commission imposes as a result of this proceeding.

89. E-Comm submitted that the 9-1-1 network providers should file with the Commission their network restoration strategies and associated timelines.

90. PIAC submitted that it may be useful for 9-1-1 network providers to provide the Commission with annual reports or audits, such as audits of circuit diversity, as well as publicly available reports on 9-1-1 network providers' progress regarding the development and improvement of their 9-1-1 networks.

91. TCC submitted that additional monitoring would divert 9-1-1 network providers' resources to regulatory reporting functions from more critical, day-to-day network fulfillment tasks.

92. Bell Canada submitted that since Canadians already benefit from robust 9-1-1 networks, there is no justification for the creation of Commission regulation or reporting requirements.

Commission's analysis and determinations

93. The 9-1-1 network reliability and resiliency requirements set out in this decision are intended to minimize the possibility of 9-1-1 calls not being delivered to PSAPs due to 9-1-1 network outages. It would therefore be appropriate for the Commission to monitor whether the 9-1-1 network reliability and resiliency practices of each 9-1-1 network provider ensure that 9-1-1 calls are delivered to PSAPs. This information would enable the Commission to identify possible trends and address concerns, as required.

94. Currently, Commission staff are being informally notified of 9-1-1 service outages that result 9-1-1 network outages, but this notification is inconsistent across 9-1-1 network providers. A requirement to provide an annual report on 9-1-1 network outages that cause 9-1-1 service outages would incent 9-1-1 network providers to take the appropriate actions to ensure the reliable provision of 9-1-1 services, and would be less burdensome and more effective than requiring them to file information about how they manage their 9-1-1 networks.

95. As such, the Commission requires all 9-1-1 network providers to file with it

- an annual report on 9-1-1 network outages that cause 9-1-1 service outages, i.e. 9-1-1 network outages during which any number of 9-1-1 calls are not delivered to the primary PSAP's demarcation point.

- These reports should detail, for each outage, the date, duration, and cause of the outage; the affected area; the remedial action taken to address the outage; as well as the number of affected calls, if this information is available.

- The first report should cover 9-1-1 network outages logged between January and December 2015, and is to be submitted by **1 June 2016**. For 2016 and subsequent years, the report is to be filed with the Commission by 30 March of the following year.

- an abridged version of this annual report, which includes aggregated information regarding 9-1-1 network outages for the public record.

Bell Canada's proposal for a confidential 9-1-1 network provider forum

Positions of parties

96. Bell Canada proposed the creation of a confidential 9-1-1 network provider forum, which would include Commission staff and 9-1-1 network provider representatives, for open discussions regarding issues that 9-1-1 network providers face. Bell Canada stated that the forum could foster further collaboration and the development of best practices and standards to achieve consistency in the reliability and resiliency of 9-1-1 services across all 9-1-1 network providers in Canada.

97. PIAC indicated that it would not be opposed to consultations among 9-1-1 network providers within a CISC group, but that it would oppose the convening of any confidential service provider forum, since accountability and transparency to the Commission and to the public are paramount in the provision of 9-1-1 services.

Commission's analysis and determinations

98. The ESWG is the appropriate forum to address issues that can be publicly disclosed pertaining to the provision of 9-1-1 services, including technical and operational implementation issues. However, it is a public forum that is open to any person, and is therefore not the appropriate forum to discuss confidential 9-1-1 matters, since the public disclosure of some of these matters could threaten the security of the 9-1-1 networks.

99. There would be benefits for 9-1-1 network providers to discuss confidential issues related to the reliability and resiliency of the 9-1-1 networks and to share best practices. 9-1-1 network providers have met in the past to discuss 9-1-1-related issues in confidence, and can continue to do so without a formal Commission requirement or forum. Therefore, the Commission encourages 9-1-1 network providers to share best practices to increase the reliability and resiliency of their 9-1-1 networks.

Policy Direction

100. The Policy Direction[17] states that the Commission, in exercising its powers and performing its duties under the Act, shall implement the policy objectives set out in section 7 of the Act, in accordance with paragraphs 1(*a*), (*b*), and (*c*) of the Policy Direction.

101. The Commission considers that its determinations in this decision are consistent with the Policy Direction for the reasons set out below.

102. The issues under consideration in this decision relate to whether the 9-1-1 networks in Canada are reliable and resilient, as well as to whether it is necessary to establish related requirements by way of regulatory measures. Given the importance of 9-1-1 services, market forces cannot be solely relied upon for their provision; therefore, regulation is necessary to ensure (i) the reliability and resiliency of the 9-1-1 networks, and (ii) the delivery of 9-1-1 service outage notifications. Therefore, subparagraphs 1(*a*)(ii)[18] and 1(*b*)(iii) and (iv)[19] of the Policy Direction apply to the Commission's determinations in this decision.

103. Consistent with subparagraphs 1(*a*)(ii) and 1(*b*)(iii) of the Policy Direction, the regulatory measures set out in this decision apply to all 9-1-1 network providers, TSP carriers, and interconnecting TSP carriers to MTS's 9-1-1 network symmetrically, and are tailored to the importance of Canadians having access to reliable and effective emergency services.

104. Consistent with subparagraph 1(*b*)(iv) of the Policy Direction, the Commission considers that its determinations related to interconnections between originating networks and 9-1-1 networks are technologically and competitively neutral and do not artificially favour either Canadian carriers or resellers.

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[17] *Order Issuing a Direction to the CRTC on Implementing the Canadian Telecommunications Policy Objectives*, P.C. 2006-1534, 14 December 2006

[18] Subparagraph 1(*a*)(ii) of the Policy Direction states that the Commission should, when relying on regulation, use measures that are efficient and proportionate to their purpose and that interfere with the operation of competitive market forces to the minimum extent necessary to meet the policy objectives.

[19] Subparagraph 1(*b*) of the Policy Direction states that the Commission, when relying on regulation, should use measures that (iii) if they are not of an economic nature, to the greatest extent possible, are implemented in a symmetrical and competitively neutral manner; and (iv) if they relate to network interconnection arrangements or regimes for access to networks, buildings, in-building wiring or support structures, ensure the technological and competitive neutrality of those arrangements or regimes, to the greatest extent possible, to enable competition from new technologies and not to artificially favour either Canadian carriers or resellers.

105. Consistent with subparagraph 1(*b*)(i) of the Policy Direction,[20] the Commission considers that the policy objectives set out in paragraphs 7(*a*), (*b*), and (*h*) of the Act[21] are advanced by the regulatory measures established in this decision.

Secretary General

Related documents

- *Matters related to the reliability and resiliency of the 9-1-1 networks*, Telecom Notice of Consultation CRTC 2015-305, 9 July 2015
- *9-1-1 action plan*, Telecom Regulatory Policy CRTC 2014-342, 25 June 2014

[20] Subparagraph 1(*b*)(i) of the Policy Direction states that the Commission, when relying on regulation, should use measures that specify the telecommunications policy objective that is advanced by those measures and demonstrate their compliance with the Policy Direction.

[21] The cited policy objectives are 7(*a*) to facilitate the orderly development throughout Canada of a telecommunications system that serves to safeguard, enrich and strengthen the social and economic fabric of Canada and its regions; (*b*) to render reliable and affordable telecommunications services of high quality accessible to Canadians in both urban and rural areas in all regions of Canada; and (*h*) to respond to the economic and social requirements of users of telecommunications services.

Appendix 1 to Telecom Regulatory Policy CRTC 2016-165

9-1-1 network definition

The following is a list of the components and transmission facilities that the Commission considers to be part of a 9-1-1 network:

- 9-1-1 primary and secondary tandem switches and/or selective routers;
- the central office switch(es) that may be used to route 9-1-1 calls from the tandem switch or selective router to the PSAP;[22]
- 9-1-1 voice trunks (or equivalent voice lines) that may be used from the point(s) of interconnection(s) with TSP carriers to the 9-1-1 primary and secondary tandem switch(es), and the point(s) of interconnection itself/themselves with TSP carriers;
- 9-1-1 voice trunks (or equivalent voice lines) from the 9-1-1 primary and secondary tandem switches to the demarcation point[23] with the PSAP's equipment or facilities;
- the equipment or platform in which the ALI primary and secondary databases reside;[24]
- the 9-1-1 data links from the point of interconnection with TSP carriers to the ALI database, and from the ALI database to the demarcation point with the PSAP;
- the Text with 9-1-1 gateway;
- the 9-1-1 data links from the Text with 9-1-1 gateway point of interconnection to both the demarcation point with the PSAP and the 9-1-1 network; and
- any other voice lines, data links, or equipment that is to be used as part of a 9-1-1 network disaster recovery solution.[25]

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[22] For some 9-1-1 network providers, the 9-1-1 network extends to both the primary and secondary PSAPs, but for the purpose of this proceeding, links to the secondary PSAPs are considered out of scope.

[23] The demarcation point is a physical boundary where the network infrastructure or hardware of the 9-1-1 service provider connects to that of the PSAP.

[24] Through these databases, the 9-1-1 caller's telephone number, the address or location of the telephone, and supplementary emergency service information on the location from which the 9-1-1 call originates are automatically displayed at the PSAP.

[25] For MTS, this includes a Centrex service as a disaster recovery solution instead of a secondary tandem.

Appendix 2 to Telecom Regulatory Policy CRTC 2016-165

Terminology for 9-1-1 network reliability and resiliency engineering principles

Several principles can be used in the *design* of a 9-1-1 network to reduce single of points of failure which, in turn, can reduce potential network downtime. These principles ensure 9-1-1 network reliability and resiliency, such that if one part of the network fails (e.g. a network connection or equipment), another part of the network can take over its function seamlessly.

- *Critical component backup* – duplication of critical components, such that if one fails, a second is ready to automatically replace it (e.g. primary and secondary 9-1-1 tandem switches and/or selective routers)

- *Location (or site) diversity* – duplication of the functionality of the system or part of the system in a different geographical location (geo-redundancy) [e.g. if a 9-1-1 tandem switch is not functional, calls are automatically re-routed to a backup 9-1-1 tandem switch that is located in a different geographical area, such as in a different city]

- *Transport network diversity* – physically diverse routes between endpoints (i.e. more than one physical route between components with no common points of failure,[26] composed of the same or different media)

- *Technology diversity* – the re-routing of calls to the PSAP using a different technology (e.g. where IP infrastructure has been deployed, the legacy network may be maintained as a backup)

- *Backup power for central offices that directly serve a primary PSAP*[27] – the provision of an alternate power source in case of a commercial power failure, i.e. generators (on-site or portable), batteries, or a combination of both, excluding functions not related to 9-1-1 services (e.g. administrative or back office functions)

- *Functionality diversity* – the transfer of functionality from one system to another (e.g. if a PSAP is not functional, or if call volumes exceed capacity, calls are re-routed to another PSAP, which handles calls on the former PSAP's behalf [e.g. through a call-handling arrangement between PSAPs])

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[26] Facilities that share a common portion are not physically diverse even if they are logically diverse for the purpose of data transmission.

[27] A central office directly serves a PSAP if it hosts a tandem switch or a selective router, or if it connects to a PSAP through a 9-1-1-dedicated trunk or an equivalent voice line.

To *maintain* the designed diversity, certain measures can be taken. These measures include periodically analyzing the geographical routing of the 9-1-1 network components to detect any changes in the original diverse design (e.g. diversity audits), and tagging the critical circuits, physically, logically, or both, to prevent inadvertent changes.

In the event that a 9-1-1 network outage occurs, downtime is dependent on how quickly the outage is *detected*. For this reason, many telephone service providers have a network monitoring centre. Telephone service providers place alarms on critical 9-1-1 network components, and these signals are relayed to the network monitoring centre using 9-1-1 network monitoring links. The use of physically diverse network monitoring links further increases the level of the 9-1-1 network's reliability.

As well, plans should be in place to *recover* from unforeseen circumstances, such that the 9-1-1 network's operation can be quickly restored. These plans can include relationships and/or priority agreements with utility services (e.g. power and gas) and municipal services (e.g. snow removal services, and water pumping services in cases of floods).