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Next-generation 9-1-1 network design efficiencies

In this decision, the Commission sets out determinations to further the implementation and provision of next-generation 9-1-1 (NG9-1-1) networks and services in Canada, so that Canadians can access new, improved, and innovative emergency services with Internet Protocol-based capabilities. The Commission aims to increase the efficiency of NG9-1-1 network design and related interconnection arrangements so that the NG9-1-1 networks are secure, reliable, resilient, and cost-effective for stakeholders.

Specifically, the Commission sets out the roles and responsibilities with respect to the Location Information Server / Additional Data Repository (LIS/ADR) functionalities and its NG9-1-1 interconnection framework. To help all Canadians benefit from the same quality of NG9-1-1 networks, the Commission imposes various obligations on telecommunications service providers and incumbent local exchange carriers (ILECs), including small ILECs.

*Finally, the Commission requests that the CRTC Interconnection Steering Committee make recommendations to the Commission, with an expectation that they be submitted by **31 October 2019**, regarding various matters related to the provision of the LIS/ADR functionalities that require further development.*

Background

1. Canadians currently have access to either Basic 9-1-1 service or Enhanced 9-1-1 (E9-1-1) service through traditional wireline, wireless, and local voice over Internet Protocol (VoIP) telephony services wherever a 9-1-1 call centre, also known as a public safety answering point (PSAP), has been established.[1]

2. When a person dials 9-1-1 in Canada today, the call travels from the network from which it was placed (the originating network)[2] to the local specialized 9-1-1 network. The 9-1-1 network then routes the call and the associated caller information (if available) to the PSAP that serves the area from which the 9-1-1 call was placed.

[1] Basic 9-1-1 service enables callers to be connected to PSAP 9-1-1 operators, who dispatch the appropriate emergency responders. E9-1-1 service includes Basic 9-1-1 service but also automatically provides PSAP 9-1-1 operators with ancillary information, such as the telephone number and location of the caller.

[2] Originating networks include traditional wireline, wireless, and local VoIP telephony networks.

The PSAP then dispatches emergency responders, such as fire, police, and ambulance, as required.

3. In Telecom Regulatory Policy 2017-182, the Commission mandated incumbent local exchange carriers (ILECs), including small ILECs, to provide next-generation 9-1-1 (NG9-1-1) networks in their incumbent territories (referred to as NG9-1-1 network providers), in order to offer telecommunications service providers (TSPs)[3] that operate within their incumbent territories wholesale access to their NG9-1-1 networks wherever provincial, territorial, and/or municipal governments have established PSAPs.

4. When NG9-1-1 is fully implemented in Canada, a request for emergency assistance (including both 9-1-1 voice calls and, once deployed, emergency requests sent by text message) will flow from the originating network to the appropriate NG9-1-1 network, as defined in the National Emergency Number Association (NENA) i3 standard (the i3 architecture standard),[4] which the Commission approved as the NG9-1-1 standard in Telecom Decision 2015-531.

5. For E9-1-1 service, any caller information associated with a 9-1-1 call, including information required to route the call to the appropriate PSAP, is stored in the Automatic Location Information / Automatic Number Information (ALI/ANI) databases. For NG9-1-1 service, these databases will be replaced by the Location Information Server (LIS) and the Additional Data Repository (ADR) functionalities.[5]

6. For E9-1-1 service, originating networks interconnect with the E9-1-1 networks at E9-1-1 tandems, also known as selective routers.[6] There are currently 30 such tandems across Canada. For NG9-1-1 service, tandems are expected to be replaced by a consolidated number of NG9-1-1 points of interconnection (POIs), allowing for increased network efficiency.

7. Given the complexity of the transition from E9-1-1 to NG9-1-1, in Telecom Regulatory Policy 2017-182, the Commission set out a number of follow-up activities, including a request that all NG9-1-1 network providers collaborate and provide the Commission with a single report detailing recommendations on the following:

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[3] For the purpose of this decision, TSPs are restricted to originating network providers of local voice telephony services, including traditional wireline, wireless, and local VoIP telephony networks. In the future, they could be expanded to include other types of providers as new NG9-1-1 services are introduced.

[4] The i3 architecture standard is an end-to-end Internet Protocol (IP)-based network architecture standard that enables the transition to IP-based networks.

[5] The LIS is a function that stores location information in IP networks for the purpose of 9-1-1. The ADR is a data storage facility for additional data, such as the device type and subscriber identity.

[6] Tandems, or selective routers, are switches or routers which, in conjunction with the information in the ALI/ANI databases, determine the appropriate PSAP to which the 9-1-1 call should be routed.

- the roles and responsibilities of the NG9-1-1 network providers and TSPs related to the provision of NG9-1-1 LISs and ADRs;

- specific NG9-1-1 network components that could be shared between NG9-1-1 network providers to take advantage of economies of scale; and

- efficient interconnection arrangements applicable to NG9-1-1 networks, especially for TSPs.

8. Subsequently, Bell Canada, Saskatchewan Telecommunications (SaskTel), and TELUS Communications Inc. (TCI), as NG9-1-1 network providers (referred to hereafter as the large ILECs), filed a joint report (referred to hereafter as the large ILECs' report)[7] that included the following recommendations:

    - the responsibilities for the LIS and ADR functionalities and their associated data should reside with TSPs, consistent with the i3 architecture standard;

    - NG9-1-1 network providers could offer a hosted service for LIS and ADR on behalf of TSPs to achieve economies of scale and national consistency. The responsibility for, and maintenance and ownership of, the data would remain with TSPs, consistent with the i3 architecture standard. TSPs would have the choice of operating their own LIS and/or ADR, or to use the hosted service;[8]

    - a minimum of two geo-diverse POIs between the TSPs' networks and the NG9-1-1 network provider's regional Emergency Services Internet Protocol (IP) Network (ESInet)[9] should be put in place to provide the right balance between (i) redundancy and resiliency, and (ii) cost and complexity; and

    - TSPs should be responsible for the costs to transit their NG9-1-1 traffic to the NG9-1-1 POIs.

The proceeding

9. In Telecom Notice of Consultation 2018-105, the Commission invited comments on the large ILECs' recommendations set out above, as well as on any additional NG9-1-1 network design efficiency opportunities that may have been overlooked in the large ILECs' report and that were not addressed in the proceeding that led to Telecom Regulatory Policy 2017-182.

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[7] Although the Commission requested that all NG9-1-1 network providers collaborate in drafting this report, the report was limited to the views of the large ILECs.

[8] Hosted services consist of outsourced systems and functions. A hosted service provider owns and oversees infrastructure; provisions interface, software, and administrative tasks; and makes the system available to clients, in this case, TSPs.

[9] The ESInet is an IP-based transport infrastructure within the NG9-1-1 network that connects originating networks with PSAPs.

10. The Commission specified that the determinations reached as a result of this proceeding would apply throughout the country, including in areas that currently offer Basic 9-1-1 service. The Commission also requested that interveners address areas of the country that do not benefit from 9-1-1 services to ensure that the Commission's resulting determinations are forward-looking and cover all regions.

11. Various parties participated in the proceeding, including the large ILECs; Bragg Communications Incorporated, carrying on business as Eastlink; Cogeco Communications Inc. (Cogeco); Groupe Maskatel LP; Quebecor Media Inc., on behalf of Videotron Ltd. (Videotron); Rogers Communications Canada Inc. (RCCI); Shaw Communications Inc. (Shaw); and TBayTel; as well as Calgary 9-1-1, the Canadian Communication Systems Alliance Inc. (CCSA), the Canadian Network Operators Consortium Inc. (CNOC), la Coalition pour le service 9-1-1 au Québec, the Deaf Wireless Canada Consultative Committee (DWCC), the Independent Telecommunications Providers Association (ITPA), and one individual.

Strategic objectives

12. A key objective of this proceeding is to increase network design efficiencies with respect to the provision of the LIS/ADR functionalities, as well as efficient interconnection arrangements. To this end, the NG9-1-1 interconnection framework should be secure, network-efficient, reliable, resilient, and cost-effective for stakeholders.

13. In addition, the policies and principles set out in previous Commission decisions have informed the Commission's rationale in this proceeding, namely,

    - the broader strategic objectives set out in Telecom Regulatory Policy 2017-182 (e.g. increasing the safety of Canadians; introducing NG9-1-1 solutions that are cost-effective, innovative, and transparent; and ensuring an effective and timely transition to NG9-1-1);

    - the obligations set out in Telecom Regulatory Policy 2017-182 (e.g. regarding reliability and resiliency, security, and component and data sovereignty);

    - that NG9-1-1 is to be based on the i3 architecture standard, allowing for deviations where necessary in the Canadian environment;

    - the E9-1-1 framework (e.g. roles and responsibilities), as well as the IP voice interconnection framework (Telecom Regulatory Policy 2012-24); and

    - the Commission's regulatory approach with respect to the small ILECs and Northwestel Inc. (Northwestel) to establish frameworks that are, as much as possible, consistent with those of the large ILECs.

Issues

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

- Who should be responsible for providing the LIS/ADR functionalities and the associated information, and should NG9-1-1 network providers be mandated to provide wholesale access to hosted LIS/ADR functionalities as part of the NG9-1-1 access tariff?
- Which type of ADR should be provided?
- Are there other matters related to the provision of the LIS/ADR functionalities that require further development?
- Are the proposed number and locations of NG9-1-1 POIs appropriate in the large ILECs' incumbent territories?
- Should the Commission mandate the provision of NG9-1-1 POIs in the small ILECs' and TCI in Quebec's incumbent territories and, if yes, subject to what considerations?
- Should the Commission mandate the provision of NG9-1-1 POIs in areas serviced by Basic 9-1-1 and in Northwestel's incumbent territory?
- Is Internet exchange-based interconnection appropriate for the exchange of NG9-1-1 traffic between TSPs and NG9-1-1 network providers?
- Is a shared-cost model for the transiting of NG9-1-1 traffic appropriate?

Who should be responsible for providing the LIS/ADR functionalities and the associated information, and should NG9-1-1 network providers be mandated to provide wholesale access to hosted LIS/ADR functionalities as part of the NG9-1-1 access tariff?

Positions of parties

15. There was general consensus among the parties that, at a minimum,

- the responsibility for the provision of the LIS/ADR functionalities should reside with TSPs that operate originating networks;
- the responsibility to update and maintain LIS/ADR information should reside with TSPs for their respective subscribers;
- the Commission should mandate the large ILECs as NG9-1-1 network providers to offer hosted LIS/ADR functionalities for national consistency and to reduce the barriers that TSPs may face in providing these functionalities; and

- TSPs should have the option to self-provision their LIS/ADR functionalities, and/or subscribe to the LIS/ADR functionalities hosted by NG9-1-1 network providers, consistent with the Network-to-Network Interface (NNI) specifications of their respective NG9-1-1 network provider.[10]

16. The ITPA and TBayTel submitted that only the large ILECs, as NG9-1-1 network providers, should be mandated to provide wholesale hosted LIS/ADR functionalities (hereafter, the hosted functionalities), since these parties do not intend to develop their own LIS/ADR functionalities, but to subscribe to the LIS/ADR functionalities of the large ILECs.

17. There were diverging views on whether the costs for the hosted functionalities should be included in the wholesale NG9-1-1 tariffed rate, or whether they should be subject to a separate tariffed rate payable only by subscribers to the hosted functionalities.

18. The large ILECs, RCCI, and Videotron generally submitted that the hosted functionalities should be part of the NG9-1-1 access tariff, and that the associated costs should be paid by all TSPs whether they opt to subscribe to the functionalities or not. These parties indicated that this would ease the administrative burden related to NG9-1-1 services and that, based on preliminary cost estimates, the expected rate for the hosted functionalities would have a marginal impact on the NG9-1-1 access service rate when applied across all of the TSPs' subscribers.

19. The CCSA, CNOC, Cogeco, and Shaw, while supporting mandated hosted functionalities, submitted that the associated rate should be separate and payable only by those that benefit from the functionalities.

Commission's analysis and determinations

20. The Commission considers that the responsibility for the provision of the LIS/ADR functionalities should reside with TSPs that operate originating networks. The Commission also considers that the responsibility for updating and maintaining LIS/ADR information should reside with TSPs for their respective subscribers, and that adopting these approaches would be consistent with the i3 architecture standard, as well as the E9-1-1 framework.

21. The large ILECs, as NG9-1-1 network providers, have indicated that they could offer the hosted functionalities for national consistency and to reduce the barriers that TSPs may face in providing these functionalities. Accordingly, the Commission considers that mandating the large ILECs to provide the hosted functionalities would be an efficient means of ensuring that they are broadly available to support NG9-1-1 across Canada.

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[10] These specifications will detail the interface and protocols through which the originating and NG9-1-1 networks will interwork.

22. However, the Commission considers that allowing TSPs to choose how to fulfill any LIS/ADR obligations, either by self-provisioning or subscribing to a hosted functionality, would ensure that they are in a position to make such functionalities available in a timely fashion, thereby supporting their readiness to provide NG9-1-1 services to their subscribers.

23. With respect to the small ILECs, the Commission notes that (i) its determinations set out in Telecom Regulatory Policy 2017-182 regarding the ILECs' NG9-1-1 obligations apply equally to all ILECs, (ii) its determinations regarding the ILECs' E9-1-1 obligations have applied equally to all ILECs, and (iii) ILECs have the option to self-provision or to outsource their NG9-1-1 network functionalities. Accordingly, the Commission considers that any obligations imposed on NG9-1-1 network providers related to the provision of the hosted functionalities should apply equally to all ILECs, as long as the NG9-1-1 network reliability and resiliency obligations set out in Telecom Regulatory Policy 2017-182 are met.

24. Additionally, the Commission considers that it would be in the public interest for the costs associated with the hosted functionalities to be included in the NG9-1-1 access tariff to support low and stable rates, and since the estimated cost is not expected to materially impact the NG9-1-1 access rate.

25. In light of all the above, the Commission

    - determines that the responsibility for the provision of the LIS/ADR functionalities resides with TSPs that operate originating networks;

    - **directs** NG9-1-1 network providers to offer wholesale hosted LIS/ADR functionalities for TSPs that operate originating networks, either by self-provisioning or outsourcing;

    - determines that TSPs have the option of self-provisioning or subscribing to the hosted functionalities;

    - determines that the responsibility for updating and maintaining LIS/ADR information resides with TSPs for their respective subscribers, regardless of whether the functionalities are provided through the hosted functionalities; and

    - determines that the costs for hosted functionalities should be included in the NG9-1-1 network providers' NG9-1-1 access tariffs.

Which type of ADR should be provided?

Background

26. The i3 architecture standard defines three different types of ADRs, depending on the type of data they store:

- Additional data about the call (Call-ADR), which provides contact information for the originating TSP, the type of originating network used by the caller, the type of device used to initiate the communication, and any subscriber information disclosed by the originating TSP;

- Additional data about the caller (Caller-ADR or Identity Searchable Additional Data Repository [IS-ADR]), which could point to information that was input by end-users, such as medical information, common addresses, biometric statistics, and emergency contact information; and

- Additional data about the location (Location-ADR), e.g. building floor plans, structure details, property management information, and fire suppression systems.

Positions of parties

27. Parties generally agreed that, for the ADR functionality, initial deployment should be limited to Call-ADR, given that any further information required for Caller-ADR and Location-ADR is not currently collected by TSPs and these functionalities have not been defined by NENA. However, the large ILECs indicated that Expanded Call-ADR, which includes information such as wireless service subscriber data that is not available with E9-1-1, could be included in the initial deployment phase.

Commission's analysis and determinations

28. TSPs currently collect information related to Call-ADR in their normal course of business. The Commission considers that, at this time, a requirement for TSPs to collect information for Call-ADR, coupled with the information in the LIS, would enable TSPs to provide at least the same level of information and functionality as is currently provided for E9-1-1 service.

29. With respect to the other types of ADR (i.e. Expanded Call-ADR, Caller-ADR, and Location-ADR), the Commission considers that it would be premature to examine the provision of these functionalities given the work that is currently underway to make them available. The Commission notes that the CRTC Interconnection Steering Committee (CISC) is currently assessing the feasibility and timelines for wireless service providers to make Expanded Call-ADR information available automatically to NG9-1-1 PSAPs, and that recommendations are expected to be submitted to the Commission in April 2019.

30. Accordingly, the Commission determines that ADR functionality providers (i.e. TSPs that opt to self-provision and NG9-1-1 network providers) must provide Call-ADR functionality for the launch of NG9-1-1 Voice service.

Are there other matters related to the provision of the LIS/ADR functionalities that require further development?

Positions of parties

31. The large ILECs submitted that the Commission should establish default routing guidelines to handle the rare cases in which calls cannot be routed because location information is not available, such as during an LIS failure. They proposed two solutions: (i) routing the call to a third-party operator that uses an ILEC-provided routing service to transfer the call to the appropriate PSAP (as is currently used for nomadic VoIP calls),[11] or (ii) routing the call by default to a PSAP designated to handle such calls.

32. Parties also identified various operational issues associated with how LIS and ADR data should be provisioned, indicating that the LIS and ADR should have, at a minimum, the same functionality and reliability as today's E9-1-1.

33. The large ILECs noted that while the i3 architecture standard defines the interface between the LIS/ADR functionalities and the NG9-1-1 network, it does not define the provisioning interface, nor how to build the functionalities, since they are deemed to fall outside the NG9-1-1 networks.

34. Accordingly, parties proposed that the Commission request that CISC make recommendations on various technical requirements and processes associated with LIS/ADR functionalities, including (i) the format of and validation criteria for the information to be provided; (ii) timelines for originating network providers to update LIS and ADR information; (iii) requirements for the reliability, resiliency, availability, confidentiality, and security of the LIS/ADR functionalities and their data; (iv) the feasibility of an access auditing mechanism; (v) the availability of information for retrieval by PSAPs after the 9-1-1 call has ended; (vi) the authentication of PSAPs accessing the LIS and ADR through the LIS/ADR providers; and (vii) the notification process for outages and data breaches or breach attempts.

Commission's analysis and determinations

35. Regarding the routing function provided by the LIS, reliability and resiliency are critical to ensure that all NG9-1-1 calls are delivered to the appropriate or designated PSAP. Accordingly, the Commission considers that provisions should be made for the default routing of calls in the unlikely event that routing information is not available, including during an LIS failure. The Commission considers it appropriate for TSPs and NG9-1-1 network providers to have arrangements in place with a

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[11] Nomadic VoIP calls are IP-based calls for which the location of the caller is not associated with the telephone number. Because of this challenge, in Telecom Decision 2005-21, the Commission directed carriers of local VoIP services to implement an interim solution using an intermediary (commonly referred to as a third-party call centre), which provides a level of service that is functionally comparable to Basic 9-1-1 service.

third-party call centre, such as those used for nomadic VoIP calls.[12] Ultimately, the responsibility for default routing depends on the entity responsible for the network where the failure occurred (i.e. the originating network or the NG9-1-1 network) and/or the entity providing the LIS functionality (whether self-provisioned or hosted).

36. The Commission notes that work is underway within CISC to develop a solution whereby third-party call centres would be directly connected to the NG9-1-1 networks for the transfer of NG9-1-1 calls (and the associated ancillary data) to the appropriate PSAP.

37. The Commission considers that the provisioning interfaces to the LIS/ADR functionalities need further development and that it would be appropriate for these interfaces to be consistent nationally. Moreover, numerous technical and operational issues, including those outlined above by parties, need to be resolved to support the launch of NG9-1-1 Voice service by the Commission-imposed deadline of 30 June 2020. The Commission considers that CISC is best positioned to make recommendations on these issues.

38. Accordingly, the Commission

- **directs** TSPs and NG9-1-1 network providers to have arrangements in place for default 9-1-1 call routing with a third-party call centre, such as those used for nomadic VoIP calls; and

- requests that CISC make recommendations to the Commission, with an expectation that they be submitted by **31 October 2019**, regarding

    i. the format of and validation criteria for the data in the LIS and Call-ADR;

    ii. timelines for information updates, which are expected to be as near to real-time as feasible;

    iii. the technical and operational requirements to be imposed on providers of the LIS/ADR functionalities, which must be reliable, resilient, and secure; and protect the confidentiality of information, including their design;

    iv. the feasibility of an access auditing mechanism;

    v. the availability of information for retrieval by PSAPs after the 9-1-1 call has ended;

[12] See Telecom Circular 2008-2, as well as Telecom Decisions 2005-21 and 2007-44.

vi. the authentication of PSAPs accessing the LIS and ADR by the LIS/ADR providers;

vii. the notification process for outages and data breaches or breach attempts;

viii. standardization of the provisioning interfaces to the hosted LIS/ADR functionalities;

ix. alternative default routing solutions to the use of a third-party call centre;[13] and

x. any other relevant technical and operational requirements related to the self-provisioned or hosted LIS/ADR functionalities.

Are the proposed number and locations of NG9-1-1 POIs appropriate in the large ILECs' incumbent territories?

Background

39. For the purpose of reliability and resiliency, the i3 architecture standard specifies that NG9-1-1 network providers must make available a minimum of two geo-redundant POIs and that TSPs must interconnect at a minimum of two geo-redundant POIs for each NG9-1-1 network where they provide service.

Positions of parties

40. The large ILECs proposed to establish 10 NG9-1-1 POIs in Canada (4 in Bell Canada's operating territory, 4 in TCI's operating territory, and 2 in SaskTel's operating territory).[14]

41. Parties generally agreed that

- the i3 architecture standard regarding geo-redundant POIs is appropriate in the Canadian environment;

- NG9-1-1 network providers should make available a minimum of two geo-redundant NG9-1-1 POIs per NG9-1-1 network to interconnect originating networks, which would increase overall NG9-1-1 network efficiency;

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[13] The option of assigning designated PSAPs to accept default routed calls would require such PSAPs to accept this additional responsibility, which may cover an area greater than their serving area; therefore, special agreements involving 9-1-1 authorities may be required.

[14] The precise locations of the proposed NG9-1-1 POIs were filed in confidence with the Commission.

- the number of proposed NG9-1-1 POIs by the large ILECs for each of their respective NG9-1-1 networks is appropriate and will increase overall network efficiency;

- the locations of the proposed NG9-1-1 POIs are appropriate, given that many NG9-1-1 POIs are located in the same cities where E9-1-1 tandems or data POIs are located and therefore where many TSPs are already present;

- at a minimum, two geo-redundant NG9-1-1 POIs should be provisioned with a physical separation of at least 100 kilometres (km) for a given NG9-1-1 network;

- TSPs should interconnect at a minimum of two geo-redundant NG9-1-1 POIs, using two facilities that take diverse paths to each used NG9-1-1 POI (i.e. for a total of four paths), to ensure the reliability of the NG9-1-1 interconnection;

- TSPs should have the option to interconnect to more than the minimum number of NG9-1-1 POIs when additional NG9-1-1 POIs are made available for increased reliability and resiliency; and

- the NG9-1-1 traffic delivered to a given NG9-1-1 POI should be localized (i.e. associated with the NG9-1-1 network provider's incumbent territory).

42. The large ILECs submitted that the challenge in determining the appropriate number of NG9-1-1 POIs is balancing reliability and resiliency principles with efficiency, and that their proposed NG9-1-1 network architecture achieves this balance.

43. The large ILECs submitted that NG9-1-1 POIs should be designed to (i) monitor critical 9-1-1 facilities, including the provision of alarms; (ii) expedite fault isolation and resolution; (iii) ensure call quality; (iv) prevent inefficiencies from overbuilding; (v) ensure reliability by providing redundancy for facilities, power, and other supporting structures for and between POIs; (vi) provide a dedicated and secure environment; (vii) support competitively neutral transport to POIs within each NG9-1-1 network; and (viii) maintain a single point of contact with NG9-1-1 network providers. Further, any designated NG9-1-1 POIs must be capable of receiving calls originating from within the associated ILEC's incumbent territory.

Commission's analysis and determinations

44. The Commission considers that the NG9-1-1 network architecture proposed by the large ILECs would meet its overall objectives for this proceeding, including that the architecture be secure, network-efficient, reliable, resilient, and cost-effective for stakeholders.

45. The transition to IP presents an opportunity to increase the efficiency and cost-effectiveness of the NG9-1-1 network architecture by consolidating POIs. In Telecom Regulatory Policy 2012-24, the Commission indicated that it was strongly

in favour of improving the efficiency of Canada's telecommunications networks and that one of the principal benefits of IP voice network interconnection cited by parties in that proceeding was the consolidation of POIs. The Commission remains of this view with respect to the transition towards NG9-1-1.

46. While the 10 NG9-1-1 POIs proposed by the large ILECs represent a reduction relative to the existing number of E9-1-1 tandems, the Commission considers that these NG9-1-1 POIs are, for the most part, located in the same cities where E9-1-1 tandems or data POIs are located and therefore where many TSPs are already present.

47. In addition, pursuant to the i3 architecture standard regarding geo-redundancy, the required number of NG9-1-1 POIs would be met in SaskTel's operating territory and exceeded in Bell Canada's and TCI's incumbent territories. Moreover, with the exception of Internet exchange-based interconnections and the shared-cost model discussed below, no TSP proposed specific alternatives to the proposed number and locations of NG9-1-1 POIs.

48. Accordingly, the Commission

    - finds that the large ILECs' proposed NG9-1-1 network architecture is consistent with the Commission's objective to establish an NG9-1-1 interconnection framework that is secure, efficient, reliable, resilient, and cost-effective for the entities involved;

    - **directs** the large ILECs to establish their NG9-1-1 POIs, as proposed in their report, for the interconnection of originating networks, by **1 January 2020**; and

    - **directs** the large ILECs to advise the Commission and affected TSPs of any significant changes to the NG9-1-1 POIs (e.g. changes in the number or locations of NG9-1-1 POIs) at least **six months** prior to the changes taking effect.

49. However, the Commission considers that, consistent with the i3 architecture standard, the interconnection of TSPs with the NG9-1-1 network at a minimum of two geo-redundant NG9-1-1 POIs, using two facilities taking diverse paths to reach each used POI, results in reliable and resilient interconnection. The Commission further considers that TSPs should be allowed to interconnect at more than the minimum of two geo-diverse POIs to further increase reliability and resiliency, if they so choose, and that these measures are consistent with the reliability and resiliency obligation set out in Telecom Regulatory Policy 2017-182.[15]

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[15] Specifically, in that decision, the Commission required NG9-1-1 network providers to take all reasonable measures to ensure that their NG9-1-1 networks are reliable and resilient to the maximum extent feasible. This includes adopting the applicable reliability and resiliency principles and practices highlighted in Telecom Regulatory Policy 2016-165.

50. Accordingly, the Commission imposes the following obligations:

- NG9-1-1 traffic delivered by TSPs to a given NG9-1-1 POI must be localized;

- TSPs must interconnect at a minimum of two geo-redundant NG9-1-1 POIs for each NG9-1-1 network where they provide service, using two facilities taking diverse paths to each used NG9-1-1 POI, with a minimum physical separation of 100 km where physically feasible;[16] and

- Large ILECs must allow TSPs to interconnect at more than two NG9-1-1 POIs where more than two NG9-1-1 POIs exist in an NG9-1-1 network provider's incumbent territory, if a TSP chooses to do so.

Should the Commission mandate the provision of NG9-1-1 POIs in the small ILECs' and TCI in Quebec's incumbent territories and, if yes, subject to what considerations?

Background

51. In Telecom Regulatory Policy 2017-182, the Commission mandated the ILECs, including the small ILECs, to provide NG9-1-1 networks in their incumbent territories and to provide wholesale access to their NG9-1-1 networks wherever PSAPs have been established. The Commission stated that the ILECs can meet these obligations either directly, by building their own NG9-1-1 networks (self-provisioning), or indirectly, by outsourcing to another ILEC (outsourcing), such as a neighbouring ILEC. The outsourcing agreements can include NG9-1-1 POIs.

52. In Telecom Regulatory Policy 2012-24, the Commission differentiated its interconnection principles based on whether the interconnecting carrier is considered to be an equal carrier to the ILEC or a customer of the ILEC. When the interconnecting carrier is considered to be an equal carrier to the ILEC, because traffic is mutually exchanged, the costs for interconnecting trunks are shared. However, when the interconnecting carrier is considered to be a customer of the ILEC, the interconnecting carrier is responsible for providing the interconnecting facilities and covering its own transiting costs.

53. In the context of 9-1-1 networks, TSPs are considered to be customers of NG9-1-1 network providers, while small and large ILECs, as NG9-1-1 network providers, are considered to be equal carriers, even though the size of their incumbent territories differs. However, should a small ILEC outsource part or all of the NG9-1-1 network functionality to a large ILEC, it is considered to be a customer of the large ILEC subject to agreements between the two ILECs.

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[16] The two NG9-1-1 POIs located in British Columbia are not 100 km apart; therefore, a TSP cannot choose to interconnect at only those two NG9-1-1 POIs.

Positions of parties

54. The ITPA submitted that the views expressed in the large ILECs' report, including the establishment of NG9-1-1 POIs, do not reflect the small ILECs' views of their role as NG9-1-1 network providers. The ITPA added that in the small ILECs' incumbent territories, competitors have relied on their existing 9-1-1 arrangements with the large ILECs to provide E9-1-1 service, and that except for CityWest Telephone Corporation, ITPA members have had no involvement in the wholesale provision of 9-1-1 networks.

55. The ITPA further submitted that, while it agrees with the principle of geo-diversity for NG9-1-1 POIs, TSPs should be required to interconnect at one POI in the small ILECs' incumbent territories due to their smaller geographical size and the small ILECs' less complex networks. NG9-1-1 network providers and most other TSPs opposed the ITPA's proposal, since it departs from the i3 architecture standard and does not meet the Commission's reliability and resiliency obligation.

56. TSPs, including RCCI and Videotron, submitted that there is no need for them to interconnect to a small ILEC's NG9-1-1 network, especially if their NG9-1-1 traffic is to be terminated at a PSAP connected to a large ILEC's NG9-1-1 network.

Commission's analysis and determinations

57. The Commission considers consistency between large ILECs and small ILECs with respect to NG9-1-1 to be of high importance to support the safety of all Canadians, regardless of whether they live in a small or large ILEC's incumbent territory. In terms of interconnection principles, the relationship between small and large ILECs, as NG9-1-1 network providers when small ILECs self-provision their NG9-1-1 network, is one of equal carriers, even though their incumbent territories differ in size.

58. Small ILECs are able to outsource part or all of the NG9-1-1 network functionality to other ILECs, if they so choose, and the small ILECs' outsourcing costs are eligible to be recovered through their NG9-1-1 access tariff. The Commission considers that given that the purpose of the NG9-1-1 network is to transit NG9-1-1 traffic from the caller to the appropriate PSAP, in cases where the PSAP is connected to a large ILEC's NG9-1-1 network, it may not be efficient for some TSPs to interconnect to the small ILEC's NG9-1-1 network. However, the small ILECs have the choice of whether to self-provision or outsource all or part of their 9-1-1 networks, including their NG9-1-1 POIs.

59. If the small ILECs choose to outsource, they can (i) designate the other ILECs' NG9-1-1 POIs as their own, provided that they are part of an outsourcing arrangement with the other ILECs, and (ii) recover their costs in their NG9-1-1 access rate.

60. With respect to the ITPA's proposal that the Commission require only one NG9-1-1 POI for interconnection to a small ILEC's NG9-1-1 network given the small size of

the small ILECs' incumbent territories and less complex networks, this would not be consistent with the i3 architecture standard and would not meet the Commission's NG9-1-1 reliability and resiliency requirements set out in Telecom Regulatory Policy 2017-182.

61. With respect to the above-mentioned requirement that geo-redundant NG9-1-1 POIs be physically separated by a minimum distance of 100 km, this may not be physically possible for small ILECs that self-provision NG9-1-1 POIs in their incumbent territories. However, the greater the physical separation, the less likely an event, such as a natural disaster, is to impact multiple NG9-1-1 POIs simultaneously.

62. Accordingly, the Commission determines that the same obligations set out in paragraphs 48 and 50 above for the large ILECs should apply equally to all NG9-1-1 network providers, including the small ILECs, with one exception. Small ILECs must make available a minimum of two geo-redundant NG9-1-1 POIs per NG9-1-1 network, with a minimum physical separation of 100 km where physically feasible, and where not feasible, with the greatest physical separation that is reasonably possible within the incumbent territory.

63. The Commission notes that TCI did not propose NG9-1-1 POIs in its incumbent territory in Quebec (hereafter, TCI in Quebec).

64. Small ILECs and TCI in Quebec must provide the proposed locations of their geo-redundant NG9-1-1 POIs, given that the TSPs that operate in their incumbent territories need to make arrangements to transit their traffic. Accordingly, the Commission **directs** the small ILECs and TCI in Quebec to advise the Commission and the TSPs operating in their incumbent territories of the location of their NG9-1-1 POIs by **7 May 2019**.

Should the Commission mandate the provision of NG9-1-1 POIs in areas serviced by Basic 9-1-1 and in Northwestel's incumbent territory?

Background

65. In Telecom Regulatory Policy 2017-182, the Commission required all ILECs to establish their NG9-1-1 networks and to be ready to provide NG9-1-1 Voice service by 30 June 2020 wherever PSAPs have been established. Consistent with this requirement, in Telecom Notice of Consultation 2018-105, the Commission specified that the determinations reached as a result of this proceeding would apply throughout the country, including in areas that currently offer Basic 9-1-1 service, to ensure that the Commission's resulting policy determinations are forward-looking and cover all regions of Canada.

Positions of parties

66. Bell Canada, on behalf of Northwestel, submitted that it has not examined the implementation of NG9-1-1 in the North to date because Northwestel provisions only Basic 9-1-1 service in Yukon. Bell Canada submitted that the government authorities

responsible for 9-1-1 have a number of issues to resolve before it is feasible to implement E9-1-1 in the North.

67. Bell Canada submitted that the implementation of NG9-1-1 networks will not result in the establishment of NG9-1-1 services, since the responsibility for assessing the feasibility and type of 9-1-1 service in a given area resides with local governments and agencies responsible for 9-1-1 services. This assessment is based on (i) the availability of ongoing operations of PSAPs and associated emergency responders, including fire, police, and emergency medical services, with clearly defined boundaries; and (ii) the availability of routable civic addressing.

Commission's analysis and determinations

68. In Telecom Regulatory Policy 2017-182, the Commission did not make an exception for the transition of Basic 9-1-1 networks to NG9-1-1 networks. A basic form of NG9-1-1 can be provided in areas where Basic 9-1-1 service is provided.

69. Accordingly, the Commission reiterates that all ILECs, including Northwestel, are to establish their NG9-1-1 networks and be ready to provide NG9-1-1 Voice service by **30 June 2020**, wherever PSAPs have been established in a particular region, and notes that only basic NG9-1-1 voice call functionalities can be provided in areas serviced by Basic 9-1-1 until the 9-1-1 authorities can meet the criteria outlined in paragraph 67 above.

70. As such, the Commission **directs** all ILECs that are 9-1-1 network providers in areas serviced by Basic 9-1-1 to advise the Commission and TSPs of the location of their NG9-1-1 POIs by **7 May 2019**. Given the size of Northwestel's incumbent territory, NG9-1-1 POIs for Northwestel, even if outsourced, should be located within its incumbent territory.

Is Internet exchange-based interconnection appropriate for the exchange of NG9-1-1 traffic between TSPs and NG9-1-1 network providers?

Positions of parties

71. With the exception of CNOC and Cogeco, parties generally agreed that Internet exchange-based interconnection (known as peering) should not be supported for the transmission of NG9-1-1 traffic due to vulnerability and security risks related to the exchange of 9-1-1 information.

72. CNOC and Cogeco submitted that Internet exchange-based interconnection could be an option for TSPs to reduce transiting costs. CNOC further submitted that any potential security concerns could be mitigated through measures such as a virtual private network (VPN) and a network security protocol.

73. The large ILECs submitted that while dedicated closed-network interconnection in an NG9-1-1 environment does not completely eliminate security risks, it greatly reduces them compared to Internet exchange-based interconnection. They added that

if Internet exchange-based interconnection were permitted, (i) the security measures required would be significant and would greatly increase the NG9-1-1 tariffed rate; and (ii) NG9-1-1 network providers could not guarantee that NG9-1-1 traffic would remain in Canada, as the Commission directed in Telecom Regulatory Policy 2017-182, unless using dedicated facilities for peering through interexchange service providers. The large ILECs indicated that the cost for using such dedicated facilities is similar to that for a dedicated IP-VPN, without the security features associated with an IP-VPN.

Commission's analysis and determinations

74. The Commission recognizes that Internet exchange-based interconnection could lead to lower interconnection costs for TSPs, especially for those that are also Internet service providers. However, the Commission considers that (i) the security risks associated with this type of interconnection would be too great, and (ii) there are no guarantees that the traffic would remain in Canada, both of which would be inconsistent with the obligations related to security, and that components and data remain in Canada, as set out in Telecom Regulatory Policy 2017-182.

75. A dedicated IP-VPN could mitigate security concerns, but this would likely offset much of the cost savings for TSPs associated with Internet exchange-based interconnection.

76. Accordingly, the Commission determines that Internet exchange-based interconnection is not to be used for the exchange of NG9-1-1 traffic between TSPs and NG9-1-1 network providers.

Is a shared-cost model for the transiting of NG9-1-1 traffic appropriate?

Positions of parties

77. Other than the small ILECs, all parties generally agreed that TSPs, including small ILECs that outsource their NG9-1-1 networks, should be responsible for the cost to transit their originating NG9-1-1 traffic to the NG9-1-1 POIs, since this is consistent with the current E9-1-1 model and the interconnection principles set out in Telecom Regulatory Policy 2012-24 when traffic is not mutually exchanged.

78. Similar to the arrangement for E9-1-1, the ITPA proposed a shared-cost model whereby small ILECs would be responsible for the cost to transit their NG9-1-1 traffic to the border of their incumbent territory or an agreed-upon point, and the large ILECs would be responsible for the cost to transit the NG9-1-1 traffic from that point to their proposed NG9-1-1 POIs.

79. The ITPA submitted that it expects the costs to transit NG9-1-1 traffic to the proposed NG9-1-1 POIs to be substantial. While the ITPA indicated that it was unable to estimate these costs accurately, since there are too many unknowns at this time, it provided an example of transiting costs using time division multiplexing (TDM)-based facilities.

80. Bell Canada submitted that the existing interconnection for E9-1-1 between it and the small ILECs is not governed by a shared-cost agreement as described by the ITPA. Bell Canada indicated that IP-based transiting would entail much lower costs than TDM-based transiting, and that competitive transport alternatives are available in major cities where small ILECs currently interconnect. While Bell Canada acknowledged that there remain too many unknowns to accurately calculate the potential cost to transit NG9-1-1 traffic from originating networks to their POIs, it estimated this cost, using NorthernTel Limited Partnership's costs as a proxy, at much less than the estimation put forth by the ITPA.

81. Most parties that did not support or that objected to the shared-cost model argued that TSPs can aggregate their NG9-1-1 traffic prior to transiting it to the consolidated NG9-1-1 POIs, which further decreases transiting costs. They submitted that a shared-cost model would (i) not be warranted since IP-based transiting costs are much lower than those for TDM-based transiting; (ii) constitute a significant departure from E9-1-1 interconnection arrangements; (iii) not be appropriate, since traffic is not mutually exchanged; (iv) be administratively burdensome; and (v) result in the industry subsidizing the TSPs that qualify for that model.

Commission's analysis and determinations

82. The Commission is not convinced by the ITPA's cost projections, given that IP transport is expected to be notably cheaper than TDM transport and should be subject to competitive IP transport alternatives.

83. Historically, the majority of small ILECs have chosen to outsource the provision of the E9-1-1 network to a neighbouring large ILEC instead of self-provisioning their E9-1-1 networks. As well, TSPs that operate within the small ILECs' territories generally interconnect to the neighbouring large ILECs' E9-1-1 networks and POIs, so their 9-1-1 traffic does not transit through the small ILECs' incumbent territories. Consequently, in terms of NG9-1-1, the only traffic that transits to the NG9-1-1 network is the small ILECs' originating 9-1-1 traffic.

84. The Commission considers that insufficient evidence has been provided to justify the proposed shared-cost model. The alternate proposal whereby TSPs operating originating networks continue to be responsible for their costs to transit their originating NG9-1-1 traffic to the NG9-1-1 POIs would be appropriate, since it is consistent with the current E9-1-1 interconnection principles set out in Telecom Regulatory Policy 2012-24 when traffic is not mutually exchanged, and since the NG9-1-1 network architecture established in this proceeding is not expected to result in unreasonable transiting costs for originating NG9-1-1 traffic.

85. Accordingly, the Commission determines that all TSPs, including small TSPs operating originating networks, are responsible for the costs to transit their NG9-1-1 traffic to the NG9-1-1 POIs.

Policy Direction

86. The Policy Direction[17] states that the Commission, in exercising its powers and performing its duties under the *Telecommunications Act* (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.

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

88. The issues considered in this decision include determining (i) whether NG9-1-1 network providers should be mandated to provide wholesale access to LIS/ADR functionalities, (ii) the number and location of NG9-1-1 POIs, and (iii) the responsibility for costs associated with the transiting of originating NG9-1-1 traffic to NG9-1-1 POIs.

89. Given the importance of 9-1-1 services for Canadians, market forces cannot be solely relied upon to govern their provision; therefore, regulation is required. In compliance with subparagraph 1(b)(i) of the Policy Direction, the regulatory measures established in this decision serve to advance the policy objectives set out in paragraphs 7(a), (b), and (c) of the Act, among others.

90. Consistent with subparagraphs 1(a)(ii) and 1(b)(iii) and (iv) of the Policy Direction, the regulatory measures established in this decision are efficient and proportionate to their purpose and interfere with the operation of competitive market forces to the minimum extent necessary to meet the policy objectives. As well, to the greatest extent possible, the Commission has implemented its regulatory measures in a symmetrical and competitively neutral manner. The measures adopted do not artificially favour either Canadian carriers or resellers.

91. Specifically, the regulatory measures established in this decision apply to all NG9-1-1 network providers and, where appropriate, to all TSPs. These measures were adopted and structured with a view to ensuring that Canadians continue to have access to reliable and effective emergency services, and that the interconnection arrangements necessary to ensure the proper provisioning of NG9-1-1 services are efficient, reliable, and cost-effective.

Secretary General

Related documents

- *Next-generation 9-1-1 network design efficiencies*, Telecom Notice of Consultation CRTC 2018-105, 26 March 2018; as amended by

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

Telecom Notices of Consultation CRTC 2018-105-1, 28 March 2018; and 2018-105-2, 19 April 2018

- *Next-generation 9-1-1 – Modernizing 9-1-1 networks to meet the public safety needs of Canadians*, Telecom Regulatory Policy CRTC 2017-182, 1 June 2017; as amended by Telecom Regulatory Policy CRTC 2017-182-1, 28 January 2019

- *Matters related to the reliability and resiliency of the 9-1-1 networks*, Telecom Regulatory Policy CRTC 2016-165, 2 May 2016

- *CISC Emergency Services Working Group – Consensus report regarding a Next-Generation 9-1-1 network architecture standard for Canada*, Telecom Decision CRTC 2015-531, 30 November 2015

- *Network interconnection for voice services*, Telecom Regulatory Policy CRTC 2012-24, 19 January 2012

- *Emergency service obligations of nomadic local VoIP service providers related to determining the location of a 9-1-1 caller*, Telecom Circular CRTC 2008-2, 28 July 2008

- *Routing of fixed/non-native and nomadic VoIP 9-1-1 calls to public safety answering points*, Telecom Decision CRTC 2007-44, 15 June 2007

- *Emergency service obligations for local VoIP service providers*, Telecom Decision CRTC 2005-21, 4 April 2005