



Telecom Decision CRTC 2018-217

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CISC Emergency Services Working Group consensus items – Next-generation 9-1-1 technical and operational considerations and trial logistics

*The Commission **approves, with a few exceptions and modifications,** the recommendations contained in the CRTC Interconnection Steering Committee's Emergency Services Working Group's (ESWG) consensus reports ESRE0078, ESRE0079, ESRE0080, ESRE0081, and ESRE0082. It also sets out requirements and best practices stemming from these recommendations. The Commission **directs** next-generation 9-1-1 (NG9-1-1) network providers and telecommunications service providers that provide 9-1-1/NG9-1-1 services to implement the requirements that apply to them, and encourages public safety answering points to do the same. These consensus reports represent a significant milestone in the transition towards NG9-1-1 services, and the ESWG's recommendations are important for the implementation of a reliable and secure NG9-1-1 system in Canada.*

Background

1. When a 9-1-1 call is made in Canada today, it travels from the network on which it was placed (the originating network) to the local specialized 9-1-1 network. The 9-1-1 network determines which public safety answering point (PSAP), also known as a 9-1-1 call centre, serves the area from which the call was placed and directs the call to that PSAP. The PSAP then dispatches emergency responders such as fire, police, and ambulance, as required.
2. Municipal, provincial, and territorial governments are responsible for emergency responders and for establishing and managing the PSAPs that dispatch them. The Commission does not determine internal policies, procedures, and standards for these organizations, although it supports national collaboration and coordination through the CRTC Interconnection Steering Committee's (CISC) Emergency Services Working Group (ESWG) for policies, procedures, and standards that are directly related to the services provided by telecommunications service providers that provide 9-1-1/next-generation 9-1-1 (NG9-1-1) services (TSPs) and 9-1-1/NG9-1-1 network providers.¹

¹ The ESWG is an open forum that includes TSPs, 9-1-1/NG9-1-1 network providers, PSAPs, and 9-1-1/NG9-1-1 industry specialists. It was formed to address issues that relate to the provision of 9-1-1/NG9-1-1 services, such as the technical and operational implementation of these services. In the context of 9-1-1/NG9-1-1 services, TSPs provide local voice telephone services, including wireline,

3. The Commission's role in the 9-1-1 context is to exercise regulatory oversight of the access that TSPs provide to enable Canadians to contact PSAPs wherever one has been established by the local government. As part of this oversight, the Commission conducted a proceeding on the implementation and provision of NG9-1-1 networks and services in Canada.²
4. When NG9-1-1 is fully implemented in Canada, a request for emergency assistance (either a 9-1-1 call or a request sent by text message) will flow from the originating network to the NG9-1-1 network as defined in the National Emergency Numbering Association (NENA) i3 architecture standard.³ NG9-1-1 functional elements will perform such tasks as determining which PSAP serves the area from which the 9-1-1 call was placed and routing the call to that PSAP. In addition to the ancillary information provided to PSAPs today, such as the caller's callback number, the NG9-1-1 network will be capable of conveying additional data, such as photos of an accident or a fleeing suspect.
5. The Commission set out its determinations resulting from the NG9-1-1 proceeding in Telecom Regulatory Policy 2017-182, which included the following key determinations:
 - Bell Canada and TELUS Communications Inc. (TCI)⁴ are to conduct NG9-1-1 implementation trials starting no later than February 2019;
 - TSPs and NG9-1-1 network providers (Bell Canada,⁵ Saskatchewan Telecommunications (SaskTel), and TCI)⁶ are to provision NG9-1-1 Voice by 30 June 2020 and NG9-1-1 Text Messaging by 31 December 2020;⁷

wireless, and voice over Internet Protocol (VoIP) telephone networks. They are also referred to as originating network providers.

² The Commission has defined an NG9-1-1 network as beginning at and including the point of interconnection between the originating networks and the NG9-1-1 networks, and ending at the demarcation point between the NG9-1-1 networks and the PSAPs (refer to Telecom Regulatory Policy 2017-182 and Telecom Decision 2018-188).

³ The Commission approved NENA i3 as the NG9-1-1 architecture standard in Telecom Decision 2015-531. i3-compliant emergency requests will be based on Internet Protocol (IP) technology, including Session Initiation Protocol (SIP) for voice calls. NG9-1-1 is an IP-based system comprised of the transport infrastructure known as managed Emergency Services IP Networks (ESInets) and the functional elements and databases that replicate traditional enhanced 9-1-1 features and functions, plus additional capabilities, known as next-generation core services (NGCS).

⁴ Telecom Regulatory Policy 2017-182 referred to TELUS Communications Company (TCC). However, effective 1 October 2017, TCC's assets were legally transferred to TCI and TCC ceased to exist. For ease of reference, "TCI" is used in this decision.

⁵ In the proceeding that led to Telecom Regulatory Policy 2017-182, Bell Canada intervened on its own behalf and on behalf of Bell Aliant; DMTS; KMTS; NorthernTel, Limited Partnership; Northwestel Inc.; Ontera; and Télébec, Limited Partnership.

⁶ Most small incumbent local exchange carriers have indicated their intention to outsource the provision of NG9-1-1 to Bell Canada and TCI.

- current 9-1-1 networks are to be decommissioned by 30 June 2023; and
 - NG9-1-1 networks must be interconnected to form a national network.
6. The Commission also requested that CISC provide it with recommendations for the implementation of NG9-1-1 in Canada and information on the logistics of the NG9-1-1 implementation trials, including which PSAPs and TSPs will participate, which geographical areas will be covered, and recommended time frames.

The ESWG reports

7. The ESWG submitted the following consensus reports for Commission approval:
- *NG9-1-1 Originating Network Considerations*, version 1.0, 15 March 2018 (ESRE0078)
 - *ESInet and Core Component Considerations for NG9-1-1 services*, version 1.0, 15 March 2018 (ESRE0079)
 - *NG9-1-1 PSAP-based Considerations*, version 1.0, 15 March 2018 (ESRE0080)
 - *NG9-1-1 Voice Trial Logistics*, version 1.1, 15 March 2018 (ESRE0081)
 - *ESInet-to-ESInet Interconnection Logistics*, version 1.0, 4 April 2018 (ESRE0082)
8. These reports can be found in the “Reports” section of the ESWG page, which is available in the CISC section of the Commission’s website at www.crtc.gc.ca.
9. The consensus reports are based on the views of NG9-1-1 stakeholders, including PSAPs, NG9-1-1 network providers, and originating network providers. They contain many consensus recommendations concerning the technical and operational implementation of NG9-1-1 in Canada. The ESWG intentionally set out its recommendations at a high level, with details reserved for confidential, bilateral agreements between parties, to protect the security of the networks.⁸
10. The consensus reports include the ESWG’s recommended approach for routing wireless 9-1-1 calls and recommended requirements and best practices to ensure highly secure, reliable, and resilient Internet Protocol (IP)-based NG9-1-1 networks,

⁷ NG9-1-1 Voice is a service that will enable the end-to-end provision of an IP-based 9-1-1 voice call. NG9-1-1 Text Messaging is a service that will enable Canadians to request emergency assistance using Real-Time Text, a protocol in which the text message is transmitted instantly as it is being typed.

⁸ There are two types of such bilateral agreements: (i) Network-to-Network Interface agreements between the NG9-1-1 network provider and the originating network provider, or between NG9-1-1 network providers; and (ii) User-to-Network Interface agreements between the NG9-1-1 network provider and PSAPs.

as well as their interconnections and interfaces to originating networks and PSAPs' networks. As such, some of the requirements apply end-to-end – that is, they apply to originating networks, NG9-1-1 networks, and PSAPs – such that a request for emergency assistance can seamlessly transit from the caller to the PSAP.

11. The consensus reports also include a number of matters for future consideration. The ESWG proposed timelines for the resolution of matters that are required for NG9-1-1 implementation and indicated that other matters will be prioritized based on their potential impact on implementation milestones. The ESWG proposed that the associated subsequent reports, with recommendations, be filed for the Commission's approval, as appropriate.

Report ESRE0078: *NG9-1-1 Originating Network Considerations*

12. This report explores how originating networks will send IP-based NG9-1-1 requests for emergency assistance from IP-based originating networks to NG9-1-1 networks. These requests will be accompanied by associated ancillary information, such as location information used for routing calls to the PSAP serving the area. The report includes consensus recommendations related to such topics as efficient routing, IP configurations, security and quality of service from an originating network's perspective, and translation software (codecs) that PSAPs must support in order to communicate with callers' devices and networks.
13. One of the key recommendations concerns the routing of wireless 9-1-1 calls. The ESWG recommended maintaining the status quo of routing such calls based on the location of the cell site/sector receiving the call, mainly because today's mobile network technology is not always able to quickly and precisely identify a 9-1-1 caller's exact location, and suitable geographic information system (GIS) information is not currently available in most areas in Canada.⁹ In the future, as envisioned by the i3 architecture standard, routing could be based on the actual location of the wireless caller, which could further decrease the already low number of calls routed to the wrong PSAP in areas where PSAPs' territories border each other.
14. In addition, wireless service providers (WSPs) highlighted a risk regarding the timing of the availability of the NG9-1-1 network providers' trial Network-to-Network Interface (NNI) specifications. These specifications will detail the interface and protocols upon which the originating and NG9-1-1 networks will interwork. The ESWG indicated that the specifications are expected to be available in September 2018, while the implementation trial is set to begin in February 2019.
15. WSPs were concerned that this timeline could affect their readiness to launch NG9-1-1 Voice service in June 2020, since their vendors' development cycle to

⁹ GIS is a system for capturing, storing, displaying, analyzing, and managing data and associated attributes that are spatially referenced. The ESWG has created a new task to move forward on GIS: *ESTF0092 – Canadian NG9-1-1 Mapping (GIS) Data Model and Common Civic Addressing Format Considerations*.

address these specifications typically requires 12 to 18 months. To mitigate this risk, WSPs presented the NG9-1-1 network providers with a preliminary list of NNI specifications that should be assessed for gaps in advance of September 2018. In addition, WSPs plan to connect their wireless lab environment to the NG9-1-1 networks for pre-trial testing and in order to validate their specifications prior to submitting them to their vendors for development.

Report ESRE0079: *ESInet and Core Component Considerations for NG9-1-1 services*

16. This report examines how NG9-1-1 networks will route requests for emergency assistance, along with the associated ancillary information, from originating networks to PSAPs. The ESWG reviewed the i3 architecture standard and several different requirements and best practices, and made recommendations on how Canadian Emergency Services IP Networks (ESInets) and core components should be designed and built so that they are highly reliable, diverse, and redundant. The NG9-1-1 network providers have not identified any concerns or risks with regard to meeting the Commission's mandated timelines at this time.
17. The report includes recommendations for requirements and best practices, most of which apply to NG9-1-1 networks, relating to such topics as reliability, resiliency, efficient routing, and the operation, administration, maintenance, and provisioning of NG9-1-1 networks. Some of the recommendations apply end-to-end. Where appropriate, the ESWG recommended best practices, as opposed to requirements, to provide guidance regarding the NG9-1-1 network providers' obligation to take all reasonable measures to ensure that their NG9-1-1 networks are reliable and resilient to the maximum extent feasible.
18. The ESWG also recommended that the existing timelines for NG9-1-1 network providers to disclose interface and network changes, including in the context of interconnection agreements (User-to-Network Interface (UNI) agreements with PSAPs and NNI agreements with originating network providers), continue to be used.¹⁰ The timelines vary depending on the scope and impact of the changes: they generally range from one to six months but can be longer. This process ensures that stakeholders are given sufficient notice of upcoming changes.
19. Should discrepancies between interfaces arise, the ESWG recommended that the i3-compliant NG9-1-1 interface prevail over originating network and PSAP interfaces.

Report ESRE0080: *NG9-1-1 PSAP-based Considerations*

20. This report explores the PSAPs' requirements, at the launch of NG9-1-1 in 2020, regarding the ancillary information they receive today and new information, such as wireless subscriber billing information. PSAPs participating in the ESWG have also

¹⁰ These timelines were set out in Report ESRE0053, which was approved by the Commission in Telecom Decision 2011-309, and were updated in Report ESRE0065b.

identified new information they would like to receive in the medium and long term, such as photos and personal medical information.

21. The ESWG has not been able to review all PSAP-related standards; it plans to conduct further research and assessment. Important PSAP-related specifications will be contained in the UNI, which the NG9-1-1 network providers are expected to provide in September 2018. As a result, a number of topics related to the implementation of NG9-1-1 in Canadian PSAPs remain to be examined.
22. Like the WSPs, PSAPs that participated in the ESWG discussions have highlighted concerns regarding the timing of the availability of the UNI specifications from the NG9-1-1 network providers and their vendors' development cycles to address those specifications. Unlike the WSPs, however, the participating PSAPs did not set out a mitigation strategy in the report.
23. The report contains several recommendations that are matters to be further considered by the ESWG, including the following:
 - that the ESWG (in particular the originating network providers and NG9-1-1 network providers) assess the feasibility, source, data mapping, and delivery mechanisms of the data being requested by the PSAPs and make recommendations to the Commission, as appropriate, by December 2018 or sooner;
 - that the ESWG participants in this group assess the implementation of the requirements that apply end-to-end and make recommendations to the Commission, as appropriate, by December 2018 or sooner; and
 - that NG9-1-1 network providers explore the feasibility of providing a managed and/or hosted service arrangement for Canadian PSAPs and report their findings to the ESWG as soon as practical, for further assessment.¹¹
24. To help ensure a timely transition to NG9-1-1, the ESWG has also requested that the Commission encourage PSAPs to
 - educate themselves about NG9-1-1;
 - perform an assessment of the UNI specifications once they are provided by the NG9-1-1 network providers;
 - acquire the necessary expertise to guide NG9-1-1 planning, design, development, and procurement activities; and

¹¹ Although a managed and/or hosted service arrangement is not defined in the ESWG reports, the Commission understands that this type of arrangement could be one whereby NG9-1-1 network providers offer a service for PSAP functions (e.g. call and media handling and logging, computer-aided dispatch, security and system management) either by managing these functions for PSAPs that own the equipment or by providing a hosted environment.

- initiate NG9-1-1-related budget approvals and applicable procurement processes.
25. Finally, the ESWG requested that the Commission mandate NG9-1-1 network providers to provide PSAPs and their governing authorities with ongoing education and support up to the demarcation point between the NG9-1-1 network providers and the PSAPs.

Report ESRE0081: *NG9-1-1 Voice Trial Logistics*

26. The Commission mandated Bell Canada and TCI, as NG9-1-1 network providers, to conduct implementation trials within their territories commencing no later than February 2019. SaskTel is not similarly mandated, and it indicated in this report that it is unable to commit to formal participation in such trials at this time due to its unique procurement requirements as a Crown corporation and pending further investigation. This report therefore contains recommendations relating to the logistics for the NG9-1-1 implementation trials in Bell Canada's and TCI's territories.
27. While many originating network providers and PSAPs have expressed interest in participating in the trials, the ESWG has indicated that their participation is contingent on several factors, including performing due diligence, securing the necessary budget, and acquiring i3-compliant equipment following the receipt of the UNI and NNI specifications. The following is a list of trial participants as of the date the report was submitted:
- In Bell Canada's territory, Bell Canada and Shaw Communications Inc. (Shaw) have committed to participate as fixed (wireline) originating network providers, with primary PSAP Toronto Police Service and secondary PSAP Toronto Fire indicated as "pending confirmation."
 - In TCI's territory, TCI and Shaw have committed to participate as fixed (wireline) originating network providers, with primary PSAP Calgary 9-1-1 indicated as "pending confirmation." No secondary PSAP has yet been identified in TCI's territory; however, discussions were ongoing when the report was submitted. While not ideal, a backup plan using a PSAP lab environment is in place in the event that PSAPs are unable to participate in the trials in either Bell Canada's or TCI's territory.
 - Bell Mobility Inc., TELUS Mobility, Rogers Wireless Inc., and Freedom Mobile Inc. have indicated strong interest in participating in the trial as WSPs, starting no sooner than September 2019 due to their vendors' development cycles once the NNI is received and contingent on pre-trial testing.
28. From the NG9-1-1 network providers' perspective, since there are no technical limitations related to location, the trials can take place anywhere within their territories. The location of the trials is, however, contingent on the territory of the

participating originating network providers and PSAPs. Therefore, the geographic areas most likely to be covered initially will be the Greater Toronto Area and Calgary. Other areas will likely be covered as more participants join the trial.

29. The ESWG recommended a phased approach to conducting the trials, with complexity being added incrementally with each phase. This approach would allow participants to gradually build comfort and confidence with a new system, while providing them the opportunity to learn and to address any issues along the way. The recommended phases are designed to culminate in a launch date of 30 June 2020 for NG9-1-1 Voice. The ESWG recommended that the trial initially be based on NENA i3 version 2, with the exception of the quality of service strategy, which would be based on version 3, and incorporate elements from future versions as they become available, subject to the appropriate process.
30. The first phase, planned to begin no later than February 2019, would focus on trialing Session Initiation Protocol (SIP)-based test calls from end to end – that is, from the TSP’s originating network, through the ESInet and next-generation core services (NGCS) to the appropriate primary PSAP, and finally to the secondary PSAP. This trial would take place in a production environment with test calls, not actual emergency 9-1-1 calls from the public, for safety reasons. All participants would be fully i3-compliant and no legacy gateways would be used by originating network providers or PSAPs. At a minimum, fixed (wireline) and mobile (wireless) originating networks would be trialed in each of Bell Canada’s and TCI’s territories, with WSPs joining the trial around September 2019.
31. The second phase would see the addition of ancillary information contained in the Additional Data Repository (ADR),¹² while the third phase would test the transfer of calls between Bell Canada’s and TCI’s ESInets. The fourth phase would focus on NG9-1-1 Text Messaging. Subsequent phases would incorporate the Legacy Selective Router Gateway and the transfer of calls to legacy PSAPs, reflecting how the NG9-1-1 networks will be configured between the 2020 launch date and the decommissioning of enhanced 9-1-1 networks in 2023.
32. Finally, the report recommends that the Commission (i) mandate the NG9-1-1 network providers to provide the interconnection specifications to be used for the trials (UNI and NNI) by September 2018, and (ii) require originating network providers to ensure that no actual 9-1-1 calls from the public can enter the trial environment.

Report ESRE0082: *ESInet-to-ESInet Interconnection Logistics*

33. Consistent with the Commission’s determination in Telecom Regulatory Policy 2017-182, the i3 architecture standard supports the interconnection of NG9-1-1 networks. This report contains recommendations for requirements for these

¹² ADRs provide additional data about a 9-1-1 call, namely subscriber information from TSPs that could be useful to PSAPs, such as the name and callback number of the subscriber.

interconnections, which are consistent with the recommendations that apply end-to-end and include such topics as high availability, reliability, resiliency, security, and monitoring.

34. ESIInet-to-ESIInet interconnections are being designed to enable the transfer of emergency service requests across NG9-1-1 networks. This would be useful, for example, in situations where one PSAP may need to transfer information to another across municipal, provincial, or territorial borders.
35. The ESWG recommended that, at this time, the ESIInet-to-ESIInet interconnections not be designed to support one ESIInet backing up another in the event of a total NG9-1-1 network outage (e.g. SaskTel's NG9-1-1 network processing emergency requests from TCI or Bell Canada territories). Rather, NG9-1-1 network providers should continue to ensure that their NG9-1-1 networks are reliable and resilient as per established and upcoming NG9-1-1 requirements.

Commission's analysis and determinations

36. The consensus reports represent a significant milestone in the transition towards NG9-1-1 services. They are based on appropriate stakeholder representation, and there was consensus within the ESWG in developing the recommendations, which are consistent with the following strategic objectives set out in Telecom Regulatory Policy 2017-182:
 - increasing the safety of Canadians by giving them the best access to emergency services through world-class telecommunications networks;
 - providing high-quality information, services, and support to PSAPs, which ultimately enables emergency responders to effectively assist Canadians;
 - introducing NG9-1-1 solutions that are cost-effective, innovative, and transparent;
 - during the transition to NG9-1-1, maintaining the existing high-quality, reliable 9-1-1 networks;
 - ensuring an effective and timely transition to NG9-1-1; and
 - using standards-based solutions that allow for flexibility and strive for national consistency.
37. The recommendations are also consistent with the i3 architecture standard. Where this standard allows flexibility in terms of an approach, the rationale that the ESWG used in making its recommendations was appropriate, as it relied on such principles as national consistency, increased efficiency, increased reliability and resiliency, and avoidance of sunk costs.

38. The Commission considers that the ESWG's recommendations are important for the implementation of reliable and secure transmission of NG9-1-1 requests for emergency assistance from the originating networks to the PSAPs. The Commission therefore **approves** the recommendations, with a few exceptions and subject to the modifications set out below. Requirements and best practices stemming from these recommendations are set out in the Appendix to this decision. The Commission **directs** TSPs and NG9-1-1 network providers to implement the requirements that apply to them, and encourages PSAPs to do the same. The Commission also encourages NG9-1-1 network providers to adopt an adequate combination of industry best practices.
39. Due to the large number of recommendations contained in the reports, the Commission has focused the following analysis on those that have the most impact, those that require modification in its view, and those that present a risk in meeting Commission-mandated milestones.

UNI and NNI specifications

40. PSAPs and WSPs participating in the ESWG have raised concerns regarding the timing of the availability of the trial UNI and NNI specifications. The Commission considers that the WSPs' mitigating strategies will reduce the likelihood of unforeseen issues.
41. PSAPs participating in the ESWG requested that the Commission encourage Canadian PSAPs to educate themselves and prepare for the transition to NG9-1-1. The Commission considers that, similar to the approach used in Telecom Regulatory Policy 2017-182, it is appropriate to continue to encourage PSAPs to become ready for the implementation trials and for the subsequent launch of NG9-1-1 services in 2020. The Commission notes that the ESWG is continuing to work to guide the timely transition of PSAPs and their authorities to NG9-1-1 by providing a roadmap and information about PSAP equipment upgrades.
42. NG9-1-1 stakeholders have indicated that they expect the trial UNI and NNI specifications to be near-final versions, allowing mainly for improvements based on lessons learned from the implementation trials. The Commission considers reasonable the ESWG's recommendation to mandate the NG9-1-1 network providers to make the UNI and NNI specifications available to the PSAPs and originating network providers participating in the trials by September 2018.
43. However, given that the Commission has mandated that the trials begin no later than February 2019, and the fact that stakeholders agreed that the specifications be made available six months before the trials start, the trial UNI and NNI specifications should be made available by the end of August 2018. Therefore, the Commission **directs** the NG9-1-1 network providers to provide the UNI and NNI specifications as soon as practical, and no later than **31 August 2018**.

PSAP considerations

44. The following recommendations contained in the report on PSAP-based considerations (ESRE0080) were improperly framed, as they are in fact matters for future consideration by the ESWG and not recommendations for which the ESWG is seeking the Commission's approval:
- the assessment of required ancillary information;
 - PSAPs' assessment of requirements that apply end-to-end; and
 - the exploration of a managed or hosted service arrangement, provided by NG9-1-1 network providers, for PSAP functions.
45. Once the ESWG has completed its assessments regarding these matters, it should present recommendations to the Commission, as required, in a subsequent report or reports, following the timelines it indicated. As such, the Commission will not make determinations on the recommendations listed above at this time.
46. The Commission notes that although the ESWG is free to discuss the possibility of commercial service arrangements that are managed or hosted for PSAP functions by other ESWG participants, it should not be exploring these solutions under the guise of an NG9-1-1 tariffed service, as this would be a policy matter outside the purview of its mandate.
47. In addition, the ESWG recommended that the Commission mandate NG9-1-1 network providers to provide PSAPs and their governing authorities with ongoing education and support up to the demarcation point between the NG9-1-1 network provider and the PSAP. The Commission considers that this approach would be helpful to PSAPs as they transition to NG9-1-1. However, the vague nature of this recommendation renders it difficult to enforce from a regulatory perspective. Instead, the Commission **directs** Bell Canada, SaskTel, and TCI to file with the Commission, by **30 November 2018**, a report outlining their activities with regard to NG9-1-1 education and support for PSAPs and their governing authorities (e.g. bulletins, webinars, service advisor support), up to the demarcation point between the NG9-1-1 network provider and the PSAP. The reports should include (i) the actions that the NG9-1-1 network providers have taken to date and (ii) their future plans in this regard.

Trial considerations

48. The Commission is optimistic that there will be at least one primary PSAP and one secondary PSAP participating in the NG9-1-1 trials in each of Bell Canada's and TCI's territories, based on the ESWG's discussions. In the event that no PSAP is able to participate, the Commission considers that while the ESWG's backup plan of using a PSAP lab is not ideal, it will enable the trials to move forward.

49. Given the central role of the NG9-1-1 network providers in the implementation trials, as well as their relationships with the PSAPs to which they connect, the Commission expects these providers to take a leadership role in recruiting, educating, and assisting trial participants.
50. In Telecom Regulatory Policy 2017-182, the Commission mandated that the NG9-1-1 trials commence no later than February 2019 and requested that CISC provide two status reports on the trials: one by 31 December 2019 and the other by 31 December 2020. Since the list of trial participants is not yet finalized and the ESGW is currently assessing additional matters, the Commission requests that CISC submit an updated report on the trial logistics, including timelines and confirmed trial participants, by **30 November 2018**.
51. Further, since the consensus reports are silent on the use of official languages in the trials, the Commission reminds stakeholders of its determination in Telecom Regulatory Policy 2017-182 that testing of NG9-1-1 Text Messaging should be conducted with PSAPs in both official languages.

Secretary General

Related documents

- *New Brunswick 9-1-1 Bureau, on behalf of public safety answering point organizations – Application to review and vary Telecom Regulatory Policy 2017-182 regarding next-generation 9-1-1 services*, Telecom Decision CRTC 2018-188, 28 May 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
- *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
- *CISC consensus reports – Emergency Services Working Group*, Telecom Decision CRTC 2011-309, 11 May 2011

Appendix to Telecom Decision CRTC 2018-217

Requirements and best practices stemming from the ESWG consensus reports

The following are requirements and best practices stemming from the recommendations made by the ESWG in consensus reports ESRE0078, ESRE0079, ESRE0080, ESRE0081, and ESRE0082.

Requirements

Originating network providers must

1. from the inception of NG9-1-1, continue to utilize the concept of cell site/sector-based routing using Master Street Address Guide or Street Address Guide (MSAG-SAG)¹³ for wireless initial call routing (refer to ESRE0078, section 4.6, and ESRE0079, section 3.4);
2. provide location for fixed services by value, following the MSAG-SAG-based Presence Information Data Format – Location Object (PIDF-LO)¹⁴ format for civic addresses initially defined by each NG9-1-1 network provider. The PIDF-LO document is to be embedded in the body of the SIP INVITE at call setup (refer to ESRE0078, section 4.3, and ESRE0079, section 3.5);
3. provide location for mobile services by reference, to facilitate both routing and in-call location update (ICLU), following the MSAG-SAG-based PIDF-LO format for civic addresses initially defined by each NG9-1-1 network provider (refer to ESRE0078, section 4.3, and ESRE0079, section 3.5);
4. initially, statically route NG9-1-1 calls to the ESInet based on provincial Uniform Resource Identifiers (URIs) in Canada (refer to ESRE0078, section 4.13.4);
5. use only the top-level Uniform Resource Name (URN) “urn:service:sos” in the Request-URI of the SIP INVITE when presenting emergency calls to the ESInet/NGCS (refer to ESRE0079, section 3.9);
6. employ Border Control Function (BCF) capabilities in order to interconnect to an ESInet (refer to ESRE0078, section 4.5, and ESRE0079, section 3.6);

¹³ MSAG-SAG serves as a municipality’s 9-1-1 address database and is used to determine how to dispatch emergency assistance to a specific location.

¹⁴ PIDF-LO provides a flexible and versatile means to represent location information in a SIP header.

7. continue to use World Geodetic System (WGS) 84¹⁵ as the standard in Canada when location is to be provided in geodetic format (refer to ESRE0078, section 5.1);
8. support both Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6), either by supporting the industry best practice of Dual Stack¹⁶ to provide simultaneous IPv4 and IPv6 operations or, in the event the originating network has infrastructure that is not able to support both IPv4 and IPv6, by performing Network Address Protocol – Protocol Translation (NAP-PT)¹⁷ within the originating network’s ESInet/NGCS¹⁸ facing BCF (refer to ESRE0078, section 5.2);
9. utilize public IP addresses to interact with the ESInet/NGCS over the NNI (refer to ESRE0078, section 5.2);
10. fully encrypt, as per the NENA i3 architecture standard, all NG9-1-1 traffic transiting over the Internet (refer to ESRE0078, section 5.3);
11. fully encrypt, by default as per the NENA i3 architecture standard, all NG9-1-1 traffic transiting between the originating network provider’s BCF and the NG9-1-1 network’s BCF on confirmed secure and private network facilities, unless otherwise agreed to in a bilateral agreement (refer to ESRE0078, section 5.3);
12. apply quality of service (QoS) values, based on the NENA i3 architecture standard, version 3, at the edge routers of the originating network’s domain prior to sending the call to the ESInet (refer to ESRE0078, section 5.6, and ESRE0079, section 3.1);
13. if and when operating a Location Information Server (LIS),¹⁹ implement the location validation process specified in the NENA i3 architecture standard, adapted as necessary for Canadian implementation, for all LIS functions utilizing civic addresses in Canada (refer to ESRE0079, section 3.5);
14. consistent with Telecom Regulatory Policy 2017-182, as trusted entities supplying location data to NG9-1-1 networks, do so in a trustworthy and reliable manner (i.e. the location supplied is reflective of the calling device’s location), while

¹⁵ WGS is a standard used in cartography, geodesy, and navigation, including the Global Positioning System (GPS).

¹⁶ Dual Stack is a mitigating strategy for the operation of networks during the shift from IPv4 to IPv6. With this methodology, a single network infrastructure can simultaneously utilize IPv4 and IPv6 addresses to process and forward traffic efficiently.

¹⁷ NAP-PT is an IPv6-to-IPv4 translation mechanism, as defined in Request for Comments (RFC) 2765 and RFC 2766, which allows IPv6-only devices to communicate with IPv4-only devices, and vice versa.

¹⁸ NGCS are the base set of services needed to process a 9-1-1 call on an ESInet.

¹⁹ The location, which can be civic or geodetic, is provided or obtained by the LIS.

ensuring that the integrity of such location data is protected, especially in transit (refer to ESRE0079, section 3.5);

15. continue to use WGS84 as the standard datum for NG9-1-1 in Canada (refer to ESRE0079, section 3.1.1);
16. if participating in the NG9-1-1 implementation trials, assist in the development of specific and end-to-end test cases by the beginning of Q4 2018 (refer to ESRE0081, Appendix D, and ESCO0559);
17. if participating in the NG9-1-1 implementation trials, ensure that live requests for emergency assistance do not enter the test environment (refer to ESRE0081); and
18. if participating in the NG9-1-1 implementation trials, report test case results to the ESWG as they become available and share findings with the ESWG on a regular basis (refer to ESRE0081).

NG9-1-1 network providers must

1. expose a public IP address for any element within the ESInet/NGCS that is accessible by any connected entity (refer to ESRE0079, section 3.1);
2. implement Dual Stack to accommodate the simultaneous use of IPv4 and IPv6 address formats (refer to ESRE0079, section 3.1);
3. mark IP packets with the Differentiated Services Code Points (DSCP) values defined in the NENA i3 architecture standard, version 3, to meet optimum QoS requirements on the ESInets (refer to ESRE0079, section 3.1);
4. implement the end-to-end QoS strategy described in section 3.1 of ESRE0079;
5. continue to provide operational support on a 24/7/365 basis (refer to ESRE0079, section 3.2.5);
6. as an interim step in implementing NG9-1-1 in Canada, use the current MSAG-SAG as the source data for the Location Validation Functions (LVFs)²⁰ and Emergency Call Routing Functions (ECRFs)²¹ (refer to ESRE0079, section 3.4);

²⁰ LVF is a functional element in an NGCS. It is a Location-to-Service Translation (LoST) protocol server where civic location information is validated against the authoritative GIS database information. A civic address is considered valid if it can be located within the database uniquely, is suitable to provide an accurate route for an emergency call, and is adequate and specific enough to direct responders to the right location.

²¹ ECRF is a functional element in an ESInet. It is a LoST protocol server where location information (either a civic address or geo-coordinates) and a Service URN serve as inputs to a mapping function that returns a URI used to route an emergency call to the appropriate PSAP.

7. create PIDF-LO profiles within the NG9-1-1 network providers' jurisdictions, for both fixed and mobile cases (refer to ESRE0079, section 3.4);
8. if and when operating an LIS, implement the location validation process specified in the NENA i3 architecture standard, adapted as necessary for Canadian implementation, for all LIS functions utilizing civic addresses in Canada (refer to ESRE0079, section 3.5);
9. provide province-based LVF URIs to interconnected LIS operators and PSAPs (refer to ESRE0079, section 3.5);
10. carry location data for delivery to PSAP in a manner that protects the integrity of such data (refer to ESRE0079, section 3.5);
11. employ BCF capabilities to ensure that all interconnected networks are protected (refer to ESRE0079, section 3.6);
12. encrypt all traffic, by default, unless otherwise agreed to by bilateral agreement (refer to ESRE0079, section 3.6);
13. provide the Policy Store, Agency Locator, and Conference Bridge Functional Elements, as part of the NGCS, to ensure proper call routing and selective transfers (refer to ESRE0079, section 3.7);
14. implement the process to disseminate the province-specific routing data to interconnected originating networks (refer to ESRE0079, section 3.10);
15. follow the prescribed disclosures of interface and network changes, as defined in ESRE0065b, to originating network providers and PSAPs (refer to ESRE0079, section 3.13);
16. if participating in the NG9-1-1 implementation trials, assist in the development of specific and end-to-end test cases by the beginning of Q4 2018 (refer to ESRE0081, Appendix D, and ESCO0559); and
17. if participating in the NG9-1-1 implementation trials, report test case results to the ESWG as they become available and share findings with the ESWG as soon as practical (refer to ESRE0081).

In addition, with respect to ESInet-to-ESInet interconnections (refer to ESRE0082), NG9-1-1 network providers shall

18. provide private and dedicated facilities;
19. provide high availability and survivability in the event of planned or unplanned outages;

20. ensure that all physical devices and components providing ESInet-to-ESInet interconnections be architected to comply with carrier-grade standards;
21. provide a minimum of two geo-diverse physical interconnections with a separation of at least 100km between them;
22. when technically feasible and available, consider optical fibre as the preferred Layer-1 media, and Ethernet as the preferred Layer-2 technology;
23. optimize the bandwidth required on specific network ports by applying traffic-rate-shaping methodologies;
24. use private Layer-3 Virtual Private Network (VPN) services to create an ESInet-to-ESInet IP-NNI;
25. use public IP addresses, with bilateral agreement on which NG9-1-1 network provider's address space is used;
26. support Dual Stack IPv4/IPv6;
27. ensure that IP or service Maximum Transmission Units (MTUs) do not exceed the link layer MTU and support the IPv4 and IPv6 minimums;
28. utilize dynamic routing protocols to facilitate route prefix exchanges and to provide the mechanisms to achieve efficiencies for multipath routing;
29. implement NENA i3 architecture standard, version 3, DSCP values, with each regional ESInet performing egress traffic shaping and policing, in accordance with its organization's established QoS practices, while achieving the NENA i3 architecture standard, version 3, recommended packet prioritization;
30. implement Network and Transport layer security measures in accordance with each NG9-1-1 network provider's best practices;
31. allow only NG9-1-1-related traffic on the Service Interconnection;
32. support the application protocols listed in section 2.3 of ESRE0082;
33. extend current network surveillance, monitoring, and management functions at each end of the ESInet-to-ESInet IP-NNI to proactively monitor in real time the status of the interconnections and provide a timely resolution to trouble conditions;
34. size bandwidth based on ESInet-to-ESInet call transfer requirements;
35. monitor bandwidth utilization scale to meet growth, expansion, and demand, with considerations to performance; and
36. routinely perform security audits and apply security patches as appropriate.

Best practices

NG9-1-1 network providers should adopt an adequate combination of industry best practices, including those listed below.

1. Care should be taken to avoid single points of failure when designing the ESInet/NGCS to ensure that no individual circuit, hardware, software, or firmware failures break down normal IP-based communications. (refer to ESRE0079, section 3.2)
2. If an ESInet implementation cannot avoid a potential single point of failure, the failure point(s) should be documented, with rationale(s) and mitigation strategies. For example, the PSAP premises may offer only a single entry point in the building. (refer to ESRE0079, section 3.2)
3. High-availability configurations such as redundant, hot-swappable power supplies, processors, and interface cards should be considered. (refer to ESRE0079, section 3.2)
4. The ESInet design should consider resilient, redundant, physically diverse connections to each point of interconnection (POI), end office, central office, data centre, PSAP, and other such facilities that may be part of the Canadian NG9-1-1 ecosystem, where available. (refer to ESRE0079, section 3.2)
5. The ESInet, interconnection, and POI designs should consider applicable switching and/or routing protocols to enable fast failover in the event of a link or equipment failure. (refer to ESRE0079, section 3.2)
6. The ESInet/NGCS and any redundantly interconnected sites should be able to survive the total destruction of any one physical site, such as a switching centre, data centre, point of presence (POP), or POI, by either fire, flood, or other disaster (natural or otherwise). (refer to ESRE0079, section 3.2.1)
7. The network solution and supporting hardware should be designed so that any failure or maintenance of one circuit or piece of equipment will not result in a total network failure, but only the loss of connectivity associated with that circuit or equipment. For sites with redundant connectivity, loss of one such connection should not interrupt service to that site. (refer to ESRE0079, section 3.2.1)
8. The incorporation of diverse facilities into the ESInet should be considered. The NGCS and redundantly connected sites should incorporate physically diverse routes and building entrances wherever possible. (refer to ESRE0079, section 3.2.1)
9. The ESInet design should support the ability to ensure optimal delivery using traffic shaping or traffic policing in times of congestion. (refer to ESRE0079, section 3.2.5)

10. The ESInet design should utilize the most effective and feasible combination of transport technologies available to meet bandwidth and redundancy requirements. (refer to ESRE0079, section 3.2.5)
11. The ESInet/NGCS should support the automatic and manual reroute of traffic through alternative routes or systems in order to circumvent network outages and/or system failures. (refer to ESRE0079, section 3.2.5)
12. LIS functions, especially when providing location by reference, should have a high degree of reliability and resiliency in order to avoid failing calls and location updates until the emergency incident is over. (refer to ESRE0079, section 3.2.5)
13. Proper life cycling of ESInet/NGCS equipment and software, as well as proper management, planning, and testing of software and firmware upgrades, should be considered. (refer to ESRE0079, section 3.2)
14. Optical fibre should be considered as the preferred Layer-1 media and Ethernet as the preferred Layer-2 technology, where available. (refer to ESRE0079, section 3.2)
15. The ESInet should be sized to provide an appropriate level of bandwidth to support the delivery of calls and associated data from originating network providers and other interconnected ESInets to the PSAPs. (refer to ESRE0079, section 3.2.5)
16. The ESInet/NGCS should be scalable to meet growth, expansion, and demand, with considerations to performance. (refer to ESRE0079, section 3.2.5)
17. The ESInet design should support the capability of handling future SIP-based call types and callback. (refer to ESRE0079, section 3.2.5)

The Commission encourages PSAPs to

1. at a minimum, support the codecs G.711 and Adaptive Multi-Rate (AMR)/AMR-wideband for audio and H.264 for video when deployed, and optionally, support the codecs Enhanced Variable Rate Codec (EVRC), Enhanced Voice Services (EVS), G.722, G.729 for audio, and H.265 and VP8 for video (refer to ESRE0078, section 5.7);
2. implement the end-to-end QoS strategy (from edge routers of PSAPs, facing the ESInets) described in section 3.1 of ESRE0079;
3. employ BCF capabilities when interconnecting to the ESInet/NGCS (refer to ESRE0079, section 3.6);
4. encrypt all traffic, by default, unless otherwise agreed to by bilateral agreement (refer to ESRE0079, section 3.6);

5. continue to use WGS84 as the standard datum for NG9-1-1 in Canada (refer to ESRE0079, section 3.11 and ESRE0080, section 5.2);
6. take the following immediate actions:
 - a. educate themselves about NG9-1-1;
 - b. perform an assessment of the NENA i3 architecture standard for Canada and the UNI specifications;
 - c. acquire the necessary i3 expertise to guide planning, design, development, and procurement activities; and
 - d. initiate budget approvals and applicable procurement processes;
7. if participating in the NG9-1-1 implementation trials, assist in the development of specific and end-to-end test cases by the beginning of Q4 2018 (refer to ESRE0081, Appendix D, and ESCO0559);
8. if participating in the NG9-1-1 implementation trials, report test case results to the ESWG as they become available and share findings with the ESWG on a regular basis (refer to ESRE0081); and
9. if participating in the NG9-1-1 implementation trials, validate their internal network and functional elements (refer to ESRE0081).