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Interconnection Steering Committee (CISC)

Report to the CRTC

by the

Emergency Services Working Group (ESWG)

Text Messaging to 9-1-1 (T9-1-1) Service

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1 Background

On July 21, 2009, the Canadian Radio-Television and Telecommunications Commission (CRTC or Commission) issued Broadcasting and Telecom Regulatory Policy CRTC 2009-430 (the Decision), “*Accessibility of telecommunications and broadcasting services*,” which addressed unresolved issues related to the accessibility of telecommunications and broadcasting services to persons with disabilities. The Decision directed the following investigation to be conducted by the Emergency Services Working Group (ESWG):

- That the CRTC Interconnection Steering Committee (CISC) ESWG conduct an investigation and evaluation of the benefits, uses, and limitations of access to 9-1-1 services via various forms of text messaging, including SMS, IM, and RTT, as well as IP Relay and file a report (the Report) by 21 January 2010.
- The Report should address text messaging directly to PSAPs as well as text messaging to PSAPs using relay operators. The Report should identify any impediments of access to 9-1-1 via these services and propose viable solutions by which such services could be used to improve access to 9-1-1 by persons with hearing and speech disabilities.
- The Report should address possible methods of associating the caller's phone number and automatic location information with the communication with the 9-1-1 operator, methods of ensuring that communications directed to 9-1-1 reach the appropriate PSAP first, as well as the need for ease and speed of communication (without delay) between the persons with a disability and the 9-1-1 operator.
- The Report should address any changes that would be required to TSP networks to enable such services, proposed timelines for implementation, and proposals as to how the costs of implementing such changes could be supported. To the extent technically feasible, these proposals should also identify the necessary technical and/or operational changes required by the PSAPs.

The Commission, upon receiving and reviewing the Report, will determine if any follow-up actions are necessary to further address issues related to access to 9-1-1 via IP Relay and other services.

2 Introduction

The purpose of this Report is to analyze and report on the technological capabilities of text-based and relay access to 9-1-1 services and make recommendations for provisioning these services for the benefit of persons with hearing or speech disabilities, i.e. the Deaf, Hard of Hearing, or Speech Impaired (**DHHSI**) community.

For the purpose of this Report **text based** services are based on datagrams sent over the Internet or over a wireless control channel connection for the transmission of plain text messages. In this report Short Message Service (SMS), Instant Messaging (IM) and Real Time Text (RTT) technologies are examined.

Relay services require the presence of an intermediary operator. In this Report TTY Relay and IP Relay are examined.

Some of the services analyzed by this Report are confined to wireless (e.g. SMS). When wireless service is discussed herein, terminology is adopted from the ESWG report ESRE0049, Wireless E9-1-1 Phase II Stage 2 Feature Analysis.

3 ESWG Approach

The CRTC Interconnect Steering Committee (CISC) Emergency Services Working Group (ESWG) received the CRTC request through the Decision and created a new Task Identification Form (TIF) 061, “*Evaluate the Benefits, Uses and Limitations of Various Forms of Text Messaging for 9-1-1 Services as Directed in Broadcasting and Telecom Regulatory Policy CRTC 200-430.*” The ESWG began technical discussions during its regular monthly conference calls and solicited technical contributions towards Report content. In addition to the monthly calls, the ESWG TIF 061 contributors and interested parties met regularly via conference call to further the development of the report. Updated TIF 061 notes, technical contributions, and draft report sections were shared by email.

In November 2009, the TIF 61 participants agreed to consult the CISC Network Working Group (NTWG) on matters related to Internet Protocol (IP). A letter was sent to the NTWG describing five issues which the ESWG requested NTWG input. The NTWG findings documented in report **NTRE0048** are included in this report.

This Report was developed through the combined efforts and technical contributions of Wireless Service Providers (WSPs), Local Exchange Carriers (LECs), 9-1-1 Service Providers (9-1-1 SPs), Internet Service Providers (ISPs), infrastructure vendors, interested parties, and Public Safety Answering Point (PSAP) representatives.

Technological terms are introduced and explained, and systems are analyzed with recommendations issued in accordance with Commission direction. Short-term and long-term solution recommendations are identified and analyzed.

Throughout this Report, Text to 9-1-1 is referred to “**T9-1-1**”.

4 Summary of T9-1-1 Findings

The ESWG arrived at a **consensus** on the analysis herein, captured in the following lists of T9-1-1 guiding principles, methods, and near-term solution.

4.1 T9-1-1 Guiding Principles

- a) Any T9-1-1 method should involve automatic routing to the designated PSAP and provision of a location automatically, to reduce response time. In other words, relay methods are not recommended.
- b) Automatic subscriber identification through such methods as a unique telephone number is required.
- c) To minimize “time to launch” and to benefit the population of DHHSI users, a feasible near-term service solution is one that:
 - a. Utilizes existing telecommunications and 9-1-1 standards. In other words, modifying or introducing new standards would require years of development and approval, which would in turn delay the service launch date.
 - b. Utilizes existing service provider and PSAP infrastructure and operational methods, as much as possible.
 - c. Minimizes the requirement for the modification of existing network platforms or the development of any new network platforms.
 - d. Is launched nationally.
 - e. Is confined to the DHHSI community. Many operational aspects must be further developed by all stakeholders towards making T9-1-1 available for the general population. Therefore the initial near-term service solution should be kept small and confined to the DHHSI community.

- d) PSAPs will be impacted by any T9-1-1 text technology except for TTY. In these cases, PSAPs will require modified or new equipment. PSAP staff will also require training.
- e) The DHHSI community will require information on the registration for this service (should registration become necessary) and the use of this service.

4.2 T9-1-1 Methods

T9-1-1 Method	Major Findings
TTY	Technology is almost obsolete and is not favoured by the DHHSI community. A TTY emulator has been tested on a prototype wireless handset however it is not commercially available.
SMS	Current SMS standards do not support automatic routing to the designated PSAP or automatic provision of location information to the PSAP. However, a potential work-around for a near-term solution has been identified. This solution will require a technical trial to develop and validate a detailed technical service description and network architecture.
IM	Current IM standards do not support automatic subscriber identification, automatic routing to the designated PSAP, or automatic provision of location to the PSAP. At this time, no potential work-around towards a near-term solution has been identified.
RTT	Current RTT standards do not support automatic subscriber identification, automatic routing to the designated PSAP, or automatic provision of location to the PSAP. At this time, no potential work-around towards a near-term solution has been identified.

4.3 Near-Term SMS T9-1-1 Solution

The ESWG has identified a potential near-term solution (see 9.2.7 for further technical details) that utilizes wireless SMS and wireless location technology. Basically, a pre-registered DHHSI user places a “silent” 9-1-1 voice call. The call is routed to the designated PSAP and location information is provided, along with a “flag” that indicates that the caller requires a SMS response. The PSAP initiates and exchanges SMS text messages with the caller to service the emergency response. A number of alternatives for providing a “flag” to the PSAP have been proposed. The most promising alternatives include:

- **TN Preregistration:** The DHHSI person pre-registers their wireless handset telephone number (TN) via their WSP or other method. The TN is entered onto a national database that is downloaded to all ALI platforms. When a silent 9-1-1 call is presented to the PSAP, the “flag” is automatically displayed on the PSAP console.
- **Unique Area Code:** The DHHSI person receives a telephone number from a unique national area code, such as a 5XX SAC code. Existing DHHSI handset owners would be required to change their telephone numbers to one from this unique area code. When a call to 9-1-1 is placed, the unique area code can be automatically detected by PSAP infrastructure or the PSAP operator which produces the appropriate display on the PSAP console or awareness that a DHHSI person requires a SMS response. The utilization of a specific SAC or regular area code must be analyzed and issues such as call rating and local number portability must be resolved.
- **Unique Central Office Code:** This method is similar to the one above, except specific central office codes (the NXX digits in the telephone number format NPA-NXX-XXXX) are reserved and assigned exclusively to DHHSI users. Existing DHHSI handset owners would require telephone number changes. This method may create a sudden demand on NXXs by WSPs, which may drive one or more area codes (NPAs) into premature exhaust.

The above alternatives for providing a “flag” to the PSAP require further examination and the most feasible one be selected for the proposed service.

It is recommended that, **subject to ESWG work plans**, that the ESWG undertake a technical trial of the proposed near-term SMS T9-1-1 solution. This technical trial is expected to span approximately 12 to 18 months. It will include the following activities:

- Determination of the most efficient method for “flagging” a silent T9-1-1 to a PSAP;
- Determination of a SMS T9-1-1 registration process and architecture;
- Development of a detailed technical specification for the service;
- Development of a verification test plan;
- Validation of the technical specification in a controlled telecommunications environment;
- PSAP determination of the technical means, costs, funding, budgeting, and timing of implementing the T9-1-1 service;
- Cost estimation to launch the service nationally, and proposing methods to fund same;
- Determination of a reasonable rollout plan for all parties involved;
- Identification of specific PSAP staff training requirements;

- Identification of specific DHHSI community education requirements, e.g. how to register, how to place a T9-1-1 call, how to switch from voice to SMS;
- Preparation of a technical trial concluding report to the Commission.

5 Existing Services for the Deaf, Hard of Hearing, and Speech Impaired (DHHSI) Community

5.1 Telephone Typewriter or Teletypewriter (TTY) Relay

TTY Relay (also called Message Relay Service or “MRS” by service providers) is a service whereby a live operator “translates” in real-time, text messages received in TTY format into spoken words for a recipient and vice-versa. Telephone users dial the abbreviated dialling access code 7-1-1 to access the service. This service is **not** intended for emergency 9-1-1 calls.

In previous decisions the Commission required TSPs to provide relay service to their telephony customers, 24 hours a day, seven days a week. However, in Broadcasting and Telecom Regulatory Policy CRTC 2009-430, the Commission noted that *“parties to this proceeding submitted that due to limitations and obsolescence of TTY technology, the provision of TTY Relay alone is no longer the best method for persons with hearing and speech disabilities to access telephone services. These parties submitted that IP Relay and Video Relay offer significant improvements over TTY Relay and requested that the Commission require TSPs to also provide IP Relay and/or Video Relay”*.

In paragraph 21 of the Decision the Commission required that all Local Exchange Carriers (LECs), including wireless Competitive LECs (CLECs) and Voice over Internet Protocol (VoIP) providers that are required to provide TTY Relay to also provide IP Relay, 24x7 by 21 July 2010. TSPs may meet this requirement directly or by outsourcing the provision of the service to a third-party.

After 21 July 2010, all references to “message relay service” in the existing relay service requirements shall be construed to include both TTY relay and IP relay. This concerns regular telecommunications service only and is not intended for emergency 9-1-1 calls. Consequently this report will address IP Relay and will not examine TTY Relay access to 9-1-1 services.

5.2 Internet Protocol (IP) Relay

Internet Protocol Relay Service (IP Relay) is defined in Appendix 1 of the Decision. It states, *“in an IP Relay call, the relay operator communicates with the person with a hearing or speech disability via text and the person without a hearing or speech disability via voice. The person with a disability accesses the service by using any device capable of Internet access to reach the relay provider’s website and/or text messaging application to reach the relay operator. The person without a disability dials a toll free number to reach the relay operator using any telephone service. While access to the Internet and a device capable of Internet access are necessary for the person with a disability to communicate with the IP Relay operator, these two items are not part of the relay service offering.”* Like the TTY Relay service, the IP Relay service is **not** intended for emergency 9-1-1 calls

5.3 US Telecom Relay Service (TRS)

In the United States, the FCC has established the Telecom Relay Service (TRS), which consists of IP Relay and the Video Relay Service (VRS). In FCC DA 09-2389 (released November 5, 2009), the FCC clarified the use of TRS Communications Assistant Identification Numbers (CA IDs). On June 24, 2008, the FCC released the first TRS Order in which it adopted a uniform system for assigning users of VRS and IP Relay ten-digit numbers linked to the North American Numbering Plan (NANP). The numbering system was designed to further functional equivalency by ensuring that Internet-based TRS users can be reached by voice telephone users in the same way as voice telephone users are reached, as opposed to assigning dynamic (changing) IP addresses. The numbering system was also intended to ensure that emergency calls placed by Internet-based TRS users will be routed directly and automatically to designated emergency services authorities by Internet-based TRS providers. It is important to note this method for achieving direct and automatic routing to the designated emergency authority.

6 Text Services – General Description

6.1 Teletypewriter (TTY)

6.1.1 Description

A TTY (also known as a Telecommunications Device for the Deaf “TDD”) is an electronic device for text communication via a telephone line used when one or more of the parties have hearing or speech difficulties.

Modern electronic Teletypewriter (TTY) devices incorporate a QWERTY keyboard, display screen and acoustic coupler or a RJ-11 jack for direct telephone line connection. The TTY sends characters encoded by frequency shift keying (FSK) over the voice channel of a telephone line in accordance with the ITU Recommendation V.18. Currently, computers equipped with appropriate software and a modem can emulate a V.18 TTY device.

6.1.2 Analysis

TTY devices are used on traditional wireline telephone systems. When calling 9-1-1 with a TTY device, the voice-based E9-1-1 system is used to route the TTY messaging via in-band signalling. The call is automatically routed to the designated PSAP. The PSAP automatically receives telephone number (ANI) and location (ALI) information. However, note that a PSAP has **no indication** that the incoming 9-1-1 call is from a TTY device, except from the audio baudot tones which may or not be heard by the PSAP operator.

It has been reported that TTY is a near-obsolete technology and the devices are bulky which makes them non-portable. The DHHSI community has expressed that this technology no longer meets its needs and the use of such devices is continually declining in favour of more recent and convenient services such as Short Message Service over mobile devices.

In Broadcasting and Telecom Regulatory Policy CRTC 2009-430, paragraph 30 states, *“First, reliable direct TTY-to-TTY access to 9-1-1 service is not guaranteed in all regions of Canada, largely because not all PSAPs are TTY-equipped. Second, there are inherent delays in using a TTY Relay operator to contact 9-1-1. Third, the caller’s location and phone number are not automatically transmitted to the PSAP during a relay call as it is the relay operator who makes the call.”*

6.1.3 Recommendation

Since TTY remains to this date the only possible direct text access to 9-1-1, it is recommended to explore potential solutions that may alleviate totally or partially some of the inherent limitations with the current devices. As such, solutions for direct TTY communications with the PSAP are explored in this Report.

6.2 Short Message Service (SMS)

6.2.1 Description

Short Message Service (SMS) text messaging is a wireless communication service that uses standardized communications protocols to allow the interchange of short text messages between mobile devices. Users enter the message through the 12-character E.161 alphanumeric keypad (shown in Figure 1 below) on the mobile device, e.g. by pressing “3” to specify an “e”, or by using a wireless handset with a QWERTY keyboard. Depending on which alphabet the mobile subscriber has configured in the handset, the SMS messages are limited to a maximum length message of either 160 characters, 140 characters, or 70 characters, including spaces. In Canada, in order to reach all handsets on all networks, a SMS message line **should not exceed 136 characters**. It is believed that SMS is currently one of the most widely used data applications on the planet. In some networks, the SMS messages may interact with software applications such as email.

The DHHSI community has indicated that it prefers to use a mobile handset with a QWERTY keyboard for ease of typing reasons. QWERTY keyboards are usually associated with “smartphones,” as shown in figure 3. The QWERTY keyboard mimics a regular PC keyboard, which is described in standard ISO 9995.



Figure 1. E.161 Keyboard

The deployment of the SMS service requires a specialized wireless network platform called a “Short Message Service Centre” (SMS-C) within the Wireless Service Provider’s (WSP) network. SMS messages may be sent beyond the WSP’s network via a SMS gateway platform, which provides connectivity to other WSP networks and to software applications such as email and “Short Code” value-added services (operated by an Application Service Provider, ASP) for services such as “Canadian Idol” voting. The following diagram shows a typical WSP’s SMS system.

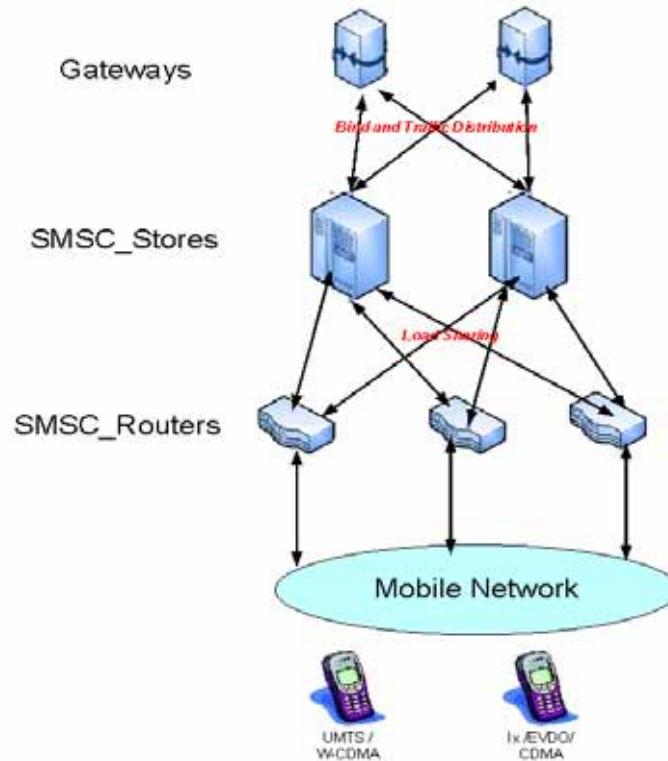


Figure 2. Typical WSP SMS Architecture

The SMS service is a “store and forward” text message service. Basically, a short text message resembling a short email or letter is composed on a mobile handset and sent to a telephone number or Short Code. The following prerequisites must be met for a successful SMS message to be sent by a mobile device:

- The mobile set must have a valid subscription that supports SMS;
- The mobile set must have the SMS capability;
- The mobile set must be registered on the WSP’s network;
- The mobile handset’s battery must be sufficiently charged to provide enough power for a series of text messages to be sent and received;

- e) If the mobile set is prepaid, it must have enough funds in its account to support sending and receiving several text messages;
- f) The serving network must support the type of SMS message that the mobile set intends on sending, e.g. Short Codes are supported.

6.2.2 Analysis

SMS Constraints

The following **constraints** associated with SMS have been identified:

- SMS 9-1-1 text messages cannot be prioritized over regular SMS text messages, exposing them to the same latency and delays as regular SMS text messages.
- The mobile handset must have a valid subscription to support the SMS service.
- A prepaid handset must have sufficient funds to support multiple text messages with the T9-1-1 service.
- The mobile handset may have a limitation on the ability to support character sets beyond the Latin / Roman alphabet used by the English and French language.
- Wireless systems have a limitation of 160, 140, or 70 characters per SMS message, depending on the deployed network equipment and handset used. In Canada, in order to reach all handsets on all networks and to ensure the message is not broken in parts that could be received in wrong order; a SMS T9-1-1 message should not exceed 136 characters.
- Commercial verbal translation services are used by PSAPs to assist in the translation into a language that the PSAP operator understands, however such services do not exist for text. Text translators are available on the internet, but both languages must be known and submitted by the user, in this case, the PSAP.
- SMS messages are based upon a “store and forward” principal. They have no guaranteed delivery times or quality of service associated with it.
- The SMS service may be affected by high SMS text volume, e.g. during New Year’s Eve, when there is a surge of SMS messages. It has been estimated that on New Year’s Eve in 2007, 4.6 SMS messages per capita were sent.
- SMS message senders do not receive confirmation of messages sent.
- Likewise, error messages are not sent to the mobile handset when a message has not been received by the destination.
- Some wireless handsets cannot accommodate a 3-digit short code, e.g. 9-1-1. As a result, the Short Code made available for a SMS to 9-1-1 service must be at least **five** digits long.
- SMS infrastructure may not have “5 nines” reliability (i.e. 99.999% uptime). In other words, the SMS service may not have the same availability as the remainder of the wireless network.

- The SMS service is unable to automatically provide a location. Currently, there is no standard for the Interworking of SMS subsystems and wireless Phase II E9-1-1 systems.
- Currently, there is no means of verifying that a SMS user is DHHSI, unless it becomes a requirement to prove that is the case prior to registration on a database of SMS T9-1-1 candidates' handsets.
- The base of handsets within each WSP need to be audited to ensure that they can transmit both voice and SMS text at the same time.
- SMS “spoofing” of the embedded telephone number may occur when a fraudster manipulates address information in order to impersonate a mobile user. Some short codes ASPs have mechanisms to prevent spoofing.
- SMS messages may be sent from a web page and would contain a 10-digit dummy number. [It is not understood by the ESWG at this point in time whether or not this method can support two-way text messaging.]
- SMS to 9-1-1 messages may contain abbreviations not understood by the message receiver.
- Foreign roamers (mobile handsets with subscriptions from outside of Canada) would not be supported because their text messages would be routed back to their home networks. Canadian (domestic) Roamers are supported if network interconnectivity permits it, e.g. the case of one Canadian WSP's subscriber roams onto the network of another Canadian WSP. SMS messages are normally routed back to the home WSP's network, therefore this is the route that a SMS T9-1-1 message would take.
- Liability concerns by all involved parties must be addressed by the Commission.

SMS does not inherently support the 9-1-1 text service due to the above facts. Further, additional architecture is required to directly route the SMS 9-1-1 text message to the designated PSAP. Also, as SMS is independent of the 9-1-1 ALI system and the WSPs' location determination platforms, a means of providing location to the PSAP is required.

The US Department of Transportation (DOT) examined SMS texting as part of its Next Generation 9-1-1 (NG9-1-1) System Initiative and has released reports, some as recent as in late 2009.¹ The US DOT analysis states that, “the demonstration showed that SMS texting was an inferior technology to support emergency calling because:

1. of its inability to support identification of callers' location information;
2. of its inability to guaranteed delivery or receipt;
3. the technology was not designed or possibly ever intended for this type of important use;

¹ ESCO0334 http://www.its.dot.gov/NG911/pubs/USDOT_NG911_FINAL_System_Design.htm
http://www.its.dot.gov/NG911/pubs/NG911_FINAL_ArchAnalysis_v1.htm

4. there are no commercial systems available that automatically identify SMS senders' location;
5. significant changes to the technology and devices are required to support location acquisition and delivery;
6. SMS does not provide the call taker with an easy method of caller interrogation; and
7. SMS was never designed to guarantee message delivery or receipt.

The report further indicates that:

- “NENA has a working group addressing operational issues, but more research must be performed to reduce risk and decrease the chance of introducing a potentially serious system design flaw.”
- “While the [SMS texting] technology was successfully demonstrated [specifically in a NG9-1-1 environment], there may be better technological options for both emergency callers and call takers over that of SMS. For example, development or modification of a **real-time texting (RTT)** (similar to instant messaging or chat) application could support delivery of caller's location, improve the ability for the call taker to quickly obtain additional critical information during their interrogation, and eliminate the 140 character limitation of SMS. Real-time texting was also successfully demonstrated in the POC (Proof of Concept).”

Benefits of SMS-based solutions

The following **benefits** have been identified as associated with SMS Text Messaging *if it is preceded by a voice call to 9-1-1*:

- SMS is readily available and widely used.
- The calls can be routed directly to the designated PSAP based on existing voice routing paths in the 9-1-1 network.
- The Call Back Number, Carrier Name and Location Information will be provided on these calls as per Wireless Phase II Stage 1, with the potential to take advantage of Stage 2 functionality which is deployed in areas commencing in 2009.
- Since the calls are routed directly to the local PSAP, it provides for the appropriate and timely emergency response which meets the need identified in paragraph 34 of Telecom Policy CRTC 2009-430 “*the need for ease of speed of communication (without delay) between persons with a disability and the 9-1-1 Operator.*”
- PSAPs would have the option to choose from one of three methods for implementing SMS for T9-1-1. The three methods include: implement in all work stations, implement in a central work station, or utilize the services of a third party. This makes it possible for large and small

PSAPs to implement a solution regardless of their technical capabilities, budgets, and time constraints.

6.2.3 Recommendation

It is recognized that SMS is widely used to communicate today, both by the general public and the DHHSI community. As such, there could be benefits from a user perspective to elaborate solutions enabling T9-1-1 service using SMS. However, it would be unrealistic to expect the inherent design of SMS to be modified to suit the need of accessing 9-1-1 in a way equivalent to what is done today with voice calls. For example, SMS messages are subject to latency and delay, which may hinder or confuse emergency communications. Also, SMS messaging systems do not have error messages to users such as “message not received at destination,” which may also hinder or confuse emergency communications. Consequently, any solutions enabling SMS T9-1-1 will have to be engineered with the inherent limitations of SMS as it is known today and accepted as such.

Cognizant of the above service limitations and potential benefits, it is recommended that SMS-based solutions be further explored. As such, several solutions were analysed for which recommendations are provided in this Report.

6.3 Instant Messaging (IM)

6.3.1 Description

Instant Messaging (IM) is an IP-based service allowing two or more users to send messages to each other via an established data connection, such as peer-to-peer over the Internet. IM is not confined to wireless systems. In fact, it is more prevalent in applications carried by Internet Service Providers (ISPs).

The following diagram illustrates how IM messages travel between wireless devices.

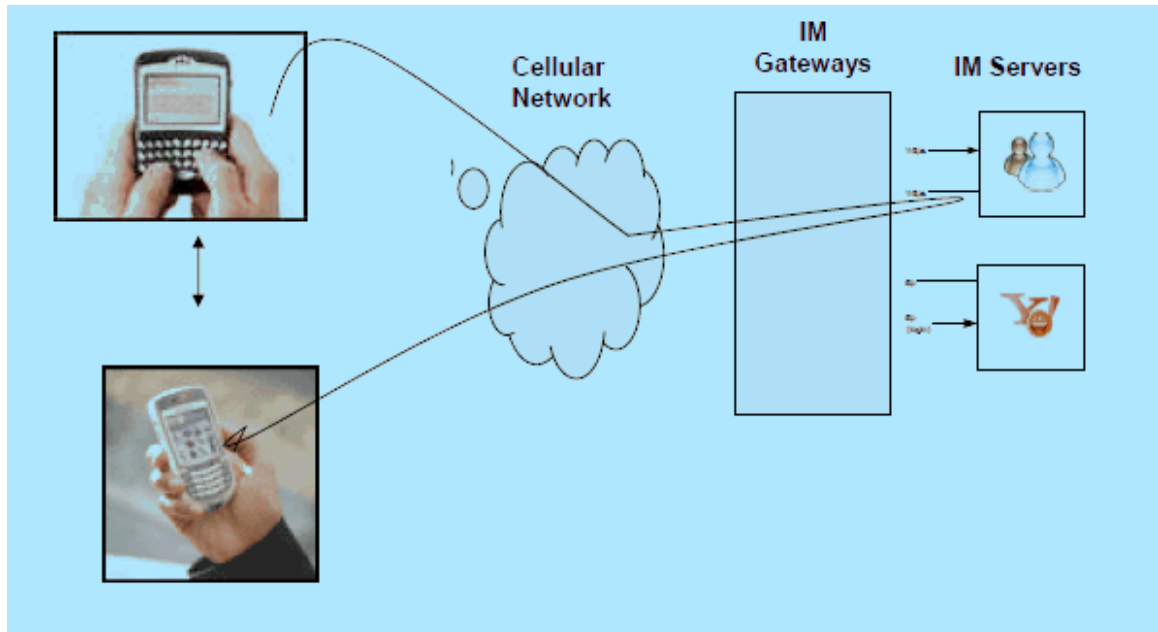


Figure 3. Example of Wireless to Wireless IM Architecture

IM requires that users' handsets:

- Have a valid subscription to a service that supports IM.
- In the case of wireless, pass registration and authentication.
- In the case of an ISP, have an active data connection with the ISP.
- Have the proper software application, such as an IM client.

IM Interconnection

IM services are currently not designed for high reliability emergency services (e.g. robustness and reliability). In the context of supporting 9-1-1 messages the interconnection Access is required to meet the standards of a typical highly available data interconnection. This would include:

- a) Route diverse physical path between the interconnecting parties POIs built on dedicated facilities
- b) Failover protection should be provided at OSI layer 1 or 2 from carrier grade technologies such as SONET protection switching or MPLS as negotiated by the interconnecting parties.
- c) Route redundancy protection at Layer 3 should be required using exterior or interior gateway protocols such as Border Gateway Reservation Protocol (BGRP), Virtual Router Redundancy Protocol (VRRP) or Open Shortest Path First (OSPF) as negotiated between the interconnecting parties
- d) Border Control functionality is required to ensure the security of the networks of the interconnecting parties and could be provided by a

network element such as a Session Border Controller or something similar.

Specific IM Applications

Windows Live IM Architecture

Windows Live Messenger is a hybrid Client-Server or Peer-to-Peer (for file transfer) application. It began as a client-server application. In the diagram below, when Client A wants to contact the Client B, The Client A logs in a CS (Connection Server) through a persistent TCP connection (eventually using proxy, gateway, etc.). Beyond the CS there is the PS (Presence Server). Each person always gets the same particular PS, which is where the personal status message, description of your user photo and similar things are stored.

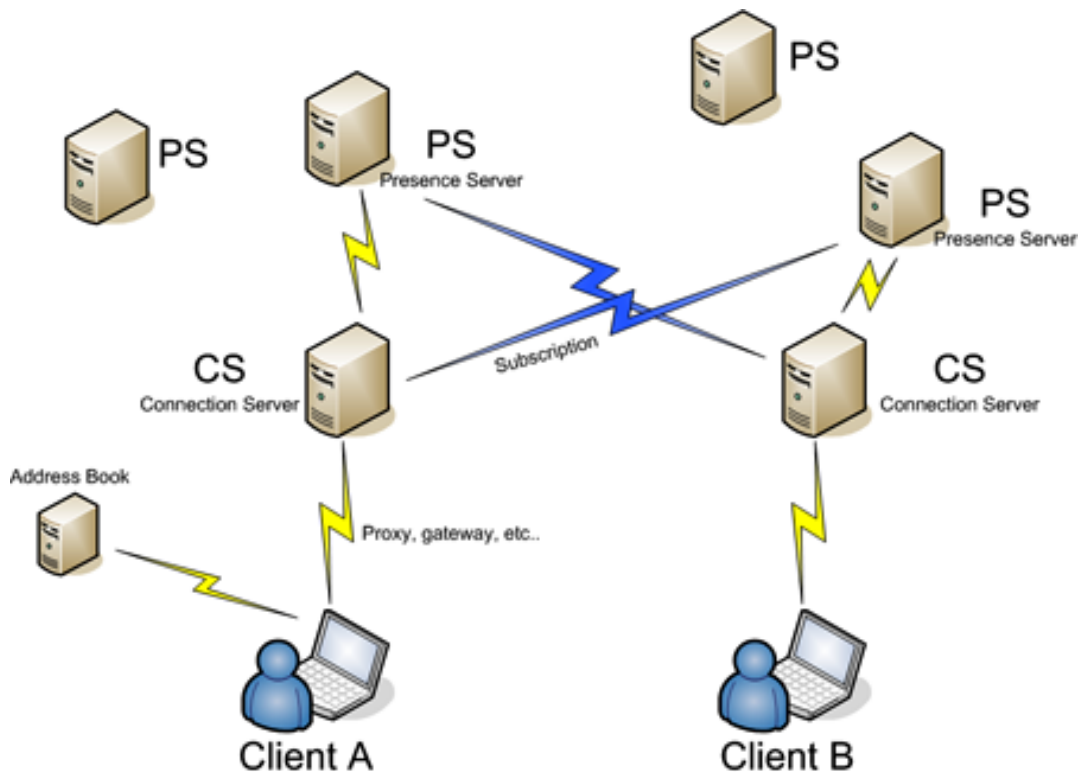


Figure 4. Windows Live Messenger - Architecture

Another element of the architecture is the Address Book. Client A gets directly from their Address Book their list of contacts. Client A informs his CS who his friends are, and the CS subscribes to his friend's PS to get the presence information that is sent up through the client server connection.

If the Client A change his status to off-Line for example, the change goes up to the CS of A, then to the PS of A, then down to the CS of B through the subscription and then down to the Client B.

Windows Live IM Chat

When Client A wants to “chat” via IM with Client B, Client A informs his CS that he/she wants to contact somebody, and the CS tells A to contact a Mixer, which sends IM traffic to a destination, for example to B (passing through the CS of B). Then, A and B can communicate through the Mixer.

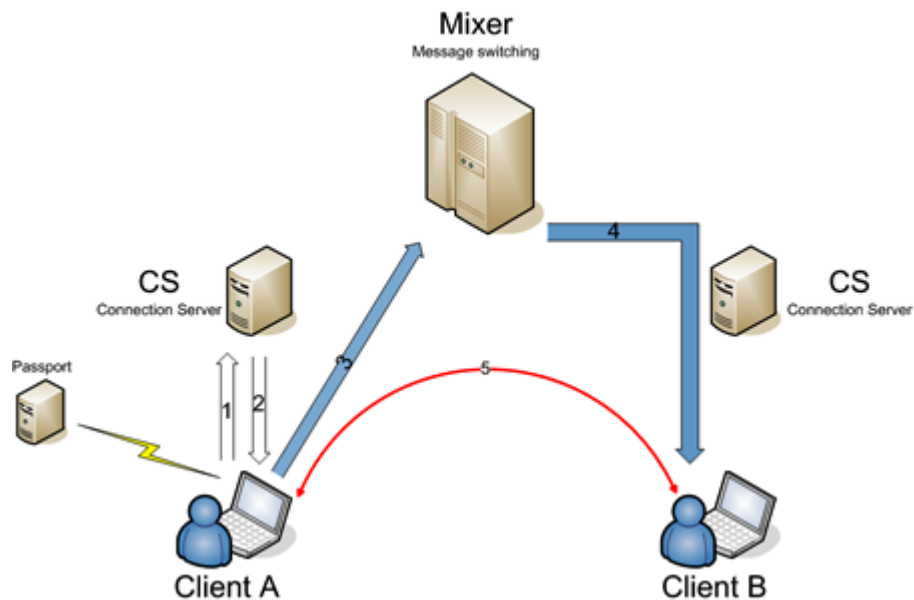


Figure 5. Windows Live Messenger - 'Chat' Architecture

Windows Live IM Peer to Peer

When the Clients A and B wants to send larger pieces of data (large files, audio, video) then they use the **Peer-to-Peer** technology. A and B set up a Session through the Mixer. They need to know how to set up a direct and secure connection, IP addresses, protocols supported, NAT or firewall information etc. If the peer to peer connection fails, A and B can always set up a connection through the Mixer.

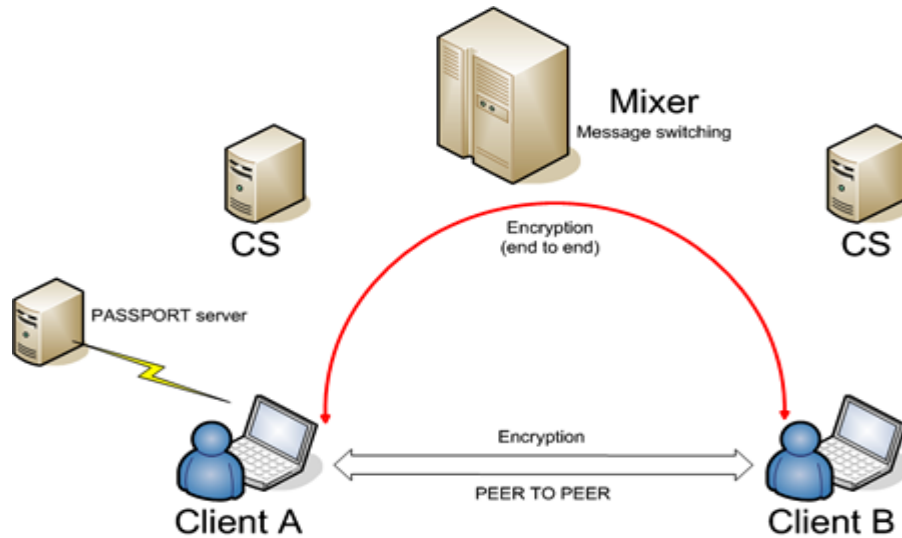


Figure 6. Windows Live Messenger - 'Peer2Peer' Architecture

For video and audio service there are specific servers with similar functions as the Mixer. The data transmission between A and B (in both peer to peer or Mixer cases) is encrypted. There is a Passport server which verifies the user authentication in order to establish the connection in a safe mode. It is important to understand that the encryption is *end to end*, which means it happens only in the Clients A and B and not in the mixer, so it does not affect performance.

Windows Live IM – Yahoo Interoperability

It is possible to add Yahoo contacts on Windows Live Messenger. If Client A wants to contact Client Y, which is a Yahoo client, this time the connection does not go through the Mixer. The client A will contact his CS, which will contact the Yahoo servers which will route to the yahoo client Y.

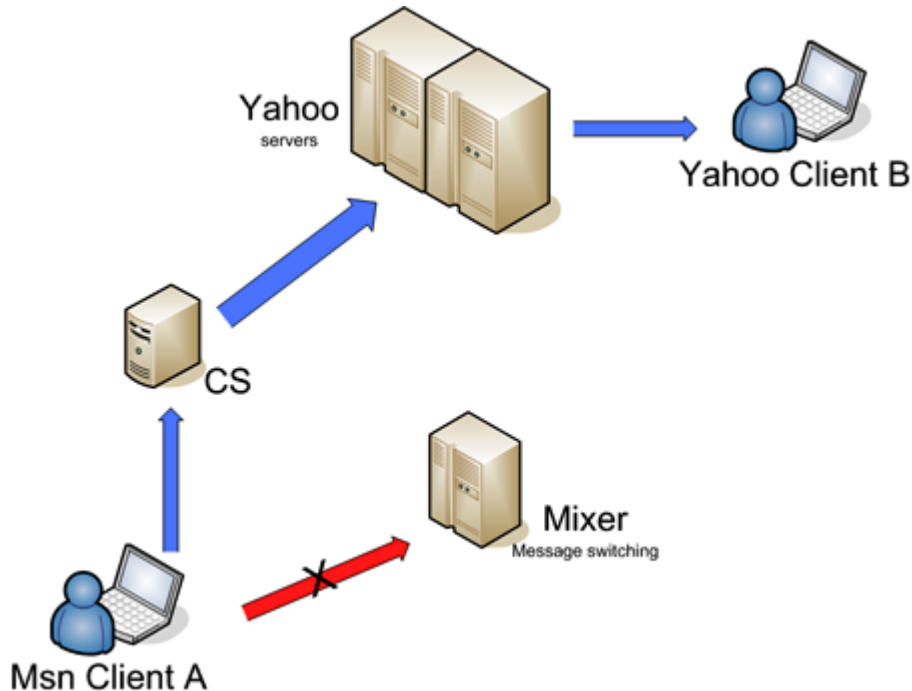


Figure 7. Windows Live Messenger - Yahoo Interoperability

6.3.2 Analysis

It is likely that most IM services may be using similar functional blocks or architectures. However, limited NTWG investigation indicates that:

- Various commercial IM services may use different protocols; and
- Inter-working of commercial IM services is not wide spread.

There are also a number of shortcomings associated with the existing IM services for the purpose of T9-1-1 service:

- Potential commercial/licensing issues, especially with non-Canadian entities;
- Interworking between IMs are generally not available; and
- There are no standard interworking mechanisms to existing location determination platforms (e.g. wireless) or no location determination platform at all (e.g., wired broadband access).

6.3.3 Recommendations

For the reasons stated in the above analysis, IM is not recommended for T9-1-1 at this point in time. As such, no solution for IM has been identified in this Report.

It is recommended that the ESWG monitors NG9-1-1 evolution and as IP and NG9-1-1 technology matures, that the ESWG consider introducing the technology in 9-1-1 call processing and PSAP environments via established CISC processes.

6.4 Real Time Text (RTT)

6.4.1 Description

RTT² is a feature that allows users to see text as it is typed into a text interface. It differs from Internet instant messaging (IM) and mobile SMS in that the characters appear in near real-time as they are typed, not as a datagram after it is written. It is not confined to wireless systems. In fact, it is more prevalent in applications supported by Internet Service Providers. RTT offers the DHHSI community a more natural, bi-directional flow of text-based conversation instead of a serial datagram process associated with IM and SMS. The core protocol of the RTT service is Session Initiated Protocol (SIP). The RTT transport standard is currently described in the Internet Engineering Task Force (IETF) Request For Comments (RFC) 4103 specification.

6.4.2 Analysis

The Real Time Text Task force (www.realtimetext.org/) identifies some trial work currently taking place in other countries. However, it is unlikely that carrier-grade Real Time Text will be deployed in the short term in Canada as there are prerequisite 9-1-1-SP /WSP/PSAP network interface issues that will need to be resolved prior to RTT implementation. Also, PSAP terminals will need IP access to support RTT technology. Database development will also be required for IP routing.³

There are operators outside of North America trialling RTT. The Australian Communications Consumer Action Network (ACCAN) has demonstrated RTT conversation over VoIP and is lobbying for its introduction in Australia to supplement the existing TTY service for the hearing and speech impaired. (<http://www.itwire.com/content/view/27154/127/>)

An article in the Canadian on-line source, straight.com, addresses RTT as a beneficial service for the hearing impaired, however, there is no known trial work taking place in Canada (<http://www.straight.com/article-198539/deaf-advocates-call-realtime-texting>).

² <http://www.realtimetext.org/index.php?pagina=27>

³ ESCO0332

Further, RTT being an IP-based, carrier-independent over-the-top service, there is a fundamental requirement for appropriate location determination platforms to be available so the 9-1-1 call can be properly routed. To this date, either there are no standard interworking mechanisms to existing location determination platforms (e.g. wireless) or no location determination platform at all (e.g., wired broadband access). Without this basic building block, a fully integrated T9-1-1 solution for RTT is difficult.

Due to deliverable timelines, NTWG was unable to source detailed IP Network requirements in support of RTT. This will require further research if required.

6.4.3 Recommendation

RTT offers exciting opportunities for the DHHSI community due to its conversational characteristics. However, for the purposes of T9-1-1, RTT and its underlying technology require further maturation prior to being considered for a T9-1-1 service. As such, no solution for RTT has been identified in this Report.

It is recommended that the ESWG monitors NG9-1-1 evolution and as IP and NG9-1-1 technology matures, that the ESWG consider introducing the technology in 9-1-1 call processing and PSAP environments via established CISC processes.

7 Survey of International Text to Emergency Services

The following text to emergency services activities outside of Canada were investigated to determine if similar methods may be applied in a Canadian T9-1-1 system.

7.1 Blackhawk County (US) SMS to 9-1-1 Trial

Description

In August, 2009, an Iowa 9-1-1 call centre became one of the first PSAPs in the United States able to receive text SMS messages. The solution implemented in Black Hawk County allows text messages to be transmitted and received within their 9-1-1 network. The system is a vendor specific solution. Intrado, an emergency communications services company, approached the PSAP about installing their new 9-1-1 texting technology because the PSAP had compatible proper call handling equipment. Black Hawk County recently upgraded to a VoIP phone system and high capacity data links together with specific CPE equipment having special software allowing it to communicate with text messages. In support of the trial, the wireless service providers in the area also agreed to route 9-1-1 texts directly into Intrado's national gateway.

Originally, those attempting to send text messages to this particular 9-1-1 centre received an automated message instructing them to make a voice call to 9-1-1. Today, the PSAP receives the text message and process it like other 9-1-1 calls. (Essentially, the calls are being received and the callers given instructions on how to input the right information to get routed to the PSAP.)

Intrado's system consists of a pair of national 9-1-1 text gateways in Colorado and in Florida (for geographical redundancy), built to receive the 9-1-1 messages routed from the WSP. The Intrado system queries the network to get the location of the cell switch where the message originated and an automated query asks the texter for the city or ZIP code they are located in. With that information the message is passed by the gateway to the proper PSAP. The PSAP operator receiving the text call can then text back from their CPE computers to conduct a conversation and ask for a more specific location.

This trial system is being referred to as Phase 0.5 'ready' Technology now is being tested by Intrado that would move the service to Phase 1 capability by automatically routing the call to the designated PSAP, by the end of the 2009. Intrado indicated they will ultimately enhance this service by providing the caller's location information (Phase 2) within the text message.

Analysis

- This trial was confined to a small area and involved only one wireless service provider.
- This trial is “sub – wireless Phase I”.
- Specialized hardware (proprietary; non-standard) is required in the PSAP.
- The US 9-1-1 system has architecture different from that of Canada.

Recommendation

This trial is not a complete solution for text to 9-1-1 but should be monitored as its findings may shed light on ways to develop a successful T9-1-1 service.

7.2 UK EmergencySMS (ESMS) Trial

Description

The UK has initiated a nationwide emergencySMS (ESMS) trial that builds upon the existing mechanisms to get text calls into the emergency call centres. This service is an add-on to the existing 999 service (the UK’s abbreviated dialling access to emergency services, similar to 9-1-1 in Canada) and Text Relay 18000 services (the UK’s speech-to-text service for textphone users, similar to 711) which were already providing text to voice call handling for emergency calls from textphones.

In order to use the service, a DHHSI person must first register through the web site www.emergencysms.org.uk or by texting the word “register” to SMS shortcode 999. When the pre-registered subscriber wishes to contact emergency services, they send a SMS message to SMS shortcode 999. The messages are sent to an emergency communications position within the 18000 Text Relay centre, which in turn verbally contacts a designated PSAP and acts as a relay point between the subscriber and the PSAP.

Reference: emergencySMS brochure from the Royal National Institute for Deaf People (RNID).

Analysis

- Pre-registration is mandatory and service is restricted to the DHHSI community.
- National deployment
- Because these calls are presented to the emergency call centre as voice calls, all the routing, prioritisation, caller ID and location information is readily available as for any other voice call. This is possible because the UK has a virtual text platform that is part of the PSTN network which already provided

the functionality for passing on the correct caller ID through the relay and other network signalling needed for location information, etc.

- **Relatively short time to deploy at minimal cost due to the leveraging on the existing infrastructure**
- Recognizes the limitations of SMS for real-time emergency communications, but also recognizes that having SMS access to emergency services, even with its limitations, is better than having no access at all.

Recommendation

This trial should be monitored as its findings may shed light on ways to develop a successful T9-1-1 service.

Further details are available at

http://www.icttnid.org.uk/downloads/3649_esmsp4p.pdf

and <http://www.emergencysms.org.uk/>

7.3 REACH112 – European Union

Description

REACH112 – an acronym depicting, “REsponding to All Citizens needing Help” – Under the auspices of the European Emergency Numbering Association (EENA), REACH112 will implement an accessible alternative to traditional voice telephony that will be suitable for all, may it be with a live real-time text conversation, with sign language, with lip reading, with voice or with any simultaneous combination of these modes described by the concept of Total Conversation.

REACH112 will implement a series of 12-month pilots in Sweden, the United Kingdom, The Netherlands, France and Spain allowing disabled users to communicate at a distance with each other and directly with the emergency services. IP devices will be provided in the homes, workplaces and on the move, connecting the users simultaneously in video, voice and text. Users will be able to connect between countries and different service providers, on mobile and fixed IP networks. The service will be integrated with existing telecommunication platforms and emergency service frameworks. The users will also connect through a third-party service (relay) with voice telephone users. Additionally, a protocol for the exchange of information between emergency services will be made available so that relevant data can be transferred to the most appropriate emergency service.

Analysis

Pilot Objectives

- Improve accessibility of 112 (112 is the abbreviated dialling access to emergency services, similar to 9-1-1 that has been adopted by the European Union; EU)
- IP devices to be used by citizens
- Total conversation: simultaneous voice, real-time text and video (for sign language for instance)
- Use of relay services (e.g. sign language to voice)
- 12 month with real emergency calls (if any)

Pilot Deployment

France

- National Emergency Platform with a deaf operator (sign & text) and a non-deaf operator (text & voice)

the Netherlands

- Direct access to 112 – standard stage 1 PSAP with Real-Time-Text (Real-time-text discussions ultimately continues with local PSAPs)

Galicia, Spain

- Direct access to 112 with Real-Time Text (possibility to activate text as well)

Sweden

- Direct access to 112 with Total Conversation (voice, real-time text and video)
- Video Relay Centre activated at the same time

United Kingdom

- National Pilot – Relay Centre: sign language/text to voice. Refer to ESMS trial above.
- Local Pilot – Local emergency centre (fire, EMS or Police) with sign language operator using video, text and voice

Some of the trials have already commenced (July 2009) and all are expected to be completed by the end of 2012.

Recommendation

These pilots/trials are longer in duration. They still should be monitored as their findings may shed light on ways to further enhance T9-1-1 services.

7.4 NENA NG9-1-1 Industry Collaboration Events

Description

The National Emergency Numbering Association (NENA) has recently determined the focus for the second series of NG9-1-1 Industry Collaboration Events (ICE). Emergency Services for the Deaf and Hard-of-Hearing Community was one of eight events selected for the next round.

These events⁴ will focus on routing, delivery, transfer, and other aspects of an emergency call internal to the NG9-1-1 system as initiated via a device using a communications medium other than voice. It is anticipated that this would include text or SMS messaging, Instant Messaging, and other technologies proposed by vendors. This event will focus on all aspects of these calls or sessions once they enter the NG9-1-1 system. If, at the time of the event, an originating network vendor wishes to participate, an end to end call scenario could also be tested.

Analysis

No information is available at the present time.

Recommendation

The ICE activities should be monitored as their findings will be key in the evolution of NG9-1-1 solutions for T9-1-1 services.

⁴ <http://www.nena.org/sites/default/files/ICE%202%20Announcement%20and%20Invitation.doc>

8 T9-1-1 Common Issues

8.1 Levels of 9-1-1 Service

The 9-1-1 service has different levels of service. It is the industry's long-term desire to migrate all telecommunications technologies to provide the highest level of 9-1-1 service, i.e. E9-1-1. The levels of service are described below.

8.1.1 Basic 9-1-1 (B9-1-1)

Basic 9-1-1 (B9-1-1) is a 9-1-1 service where the 9-1-1 call is routed to a designated PSAP where the call is directed to the required emergency agency (Police, Fire, or Ambulance). The PSAP may or may not receive the caller ID of the calling party, and does not automatically receive the geographic location of the calling party.

Basic 9-1-1 is provided by communities that do not support Enhanced 9-1-1 or where a third party call centre for non-native and nomadic VoIP services is employed in accordance with Telecom Decision CRTC 2005-21.

8.1.2 Enhanced 9-1-1 (E9-1-1)

Enhanced 9-1-1 (E9-1-1) is a 9-1-1 service where the 9-1-1 call is routed to the designated PSAP and the PSAP automatically receives caller ID and the geographic location of the caller.

In most cases, additional call control features are available to the PSAP such as Selective Routing, Selective Transfer, Forced Disconnect, Called Party Hold (Bureau Hold), Ring Back, and Switch Hook Status. A more detailed explanation⁵ follows:

9-1-1 Network Features

a) Selective Routing

⁵ NTCO0495 and NTRE0048

Selective routing occurs when the 9-1-1 call is routed to the primary PSAP assigned to the particular calling area. In order for proper routing to work, it relies on identification of the Emergency Service Number (ESN) assigned to the caller's location.

b) Selective Transfer

This feature permits the 9-1-1 call to be transferred from the PSAP to the designated emergency agency (fire, ambulance, police, poison control, etc.) that has been designated for serving that area. Available Centrex features are utilized.

c) Automatic Location Identification (ALI)

Location of origin information of the call is presented on the terminal of the PSAP attendant who receives the call, coincident with the arrival of the call. This capability usually requires the real-time transfer of call details data information from the E9-1-1 Tandem switch or PSAP equipment to the ALI computer system.

d) Automatic Number Identification (ANI)

This feature provides the E9-1-1 Tandem switch and the PSAP with the telephone number of the caller for routing and identification purposes and for purposes of calling the subscriber back.

9-1-1 Voice Features

a) Forced Disconnect

This feature allows the PSAP attendant to force the disconnection of an emergency call and release a trunk, should the caller fail to return the phone to the 'on-hook' position.

b) Called Party Hold (Bureau Hold)

This feature gives the PSAP attendant control over disconnection of an emergency call; it means that once connected to the PSAP, an emergency caller remains attached until the PSAP attendant goes 'on-hook'. This feature is not supported on current circuit switched wireless networks.

c) Ringback

This feature allows a PSAP attendant to attempt to re-establish communication with someone at the location of the caller. This feature is not supported on current circuit switched wireless networks.

d) Switch Hook Status

This feature provides the PSAP attendant with a distinctive tone to indicate that the emergency caller has gone 'on-hook'. This feature is not supported on current circuit switched wireless networks.

8.1.3 Baseline for T9-1-1

In consideration of a text-based access arrangement to the 9-1-1 service, it is necessary to establish a baseline that includes all of the features and capabilities that are currently used in the legacy 9-1-1 system, and then ultimately assess the appropriateness and feasibility for attainment of these features and capabilities in a text messaging system.

Since the Basic 9-1-1 service is less sophisticated than the Enhanced 9-1-1 service, the baseline should be derived from the features and capabilities of Enhanced 9-1-1.

8.2 Text is a Datagram

Voice conversations over telecommunications systems are two-way full duplex and are session-based. A text message is a one-way datagram whose reverse path may not be readily known. Systems involved with any T9-1-1 service must facilitate the routing and sequencing of multiple messages sent from the same user to the same message taker and vice-versa. Most text messages are transported via Internet Protocol (IP). Datagrams that are transported by IP are subject to no guarantee of delivery, no proper sequencing, and no duplicate delivery. Latency and delay may occur and are usually the result of high messaging volume. For example, it has been observed that a peak number of SMS text messages are sent on New Year's Eve, as high as 4.6 text messages per capita in 2007.

8.3 Who May Use the Service?

Per the Decision's instructions, the T9-1-1 service under study is intended for the DHHSI community. However, members of the general public that are not part of the DHHSI community may expect to use the service. For example, in some cases, a non-DHHSI person may want to silently summon emergency police assistance.

For reasons of technical simplicity, to minimize time-to-implementation and to allow the Industry to assess scalability and other deployment and operational

aspects of the adopted solution, it is recommended that this service be restricted to the DHHSI community only. A representative of the Canadian Hard of Hearing Association⁶ (CHHA) agreed with this approach. In the event that it is determined that the T9-1-1 service should be expanded to include the general public, the ESWG recommends that the Commission ask the ESWG to reconvene to address the technical and operational issues associated with a higher level of traffic of T9-1-1 messages.

One option to restrict the service to the DHHSI community is to enforce a registration process. Should registration for participation in the T9-1-1 service be required, the question remains to what extent the applicant should be confirmed as a DHHSI person. This may range from a simple declaration by the user during registration to formal submission of medical documentation during registration.

8.4 Identification of DHHSI Users

Further to who may use the T9-1-1 service discussed above, the issue of identification of DHHSI users comes to light. Some PSAPs reported that in their experience, the DHHSI community did not wish to be identified. In the initial short-term version of the T9-1-1 service, the DHHSI users must register for the service in order to confine the service to a limited community and to provide identification of the caller as requiring a response from the PSAP via SMS. Initial feedback from the Canadian Hard of Hearing Association infers the DHHSI community would be amenable to a registration-based service⁷.

While no person wishes to be identified as disabled, the ESWG believes that registration for this service is a technical necessity, as demonstrated by the UK ESMS Trial. Furthermore, the identity of the registrants in the database would be protected if access to it were kept restricted.

8.5 Network Addressing

⁶ Email from Mr. Arthur Rendall to the ESWG dated November 12, 2009. "It is also our opinion (CHHA) that SMS-9-1-1 be restricted to the disabled community of Canada and where possible to those that carry a North American mobile device within our Canadian borders only."

⁷ Email from Arthur Rendall to the ESWG, December 4, 2009, 14h02 EDT: "...comment regards to the DHHSI community not wanting to be identified. That is true to some degree in the public eye but this is a system that integrates confidentiality. I attended a Region of PEEL conference Dec 3,[2009] celebrating an international day for disabled and sat with a table full of deaf persons. I asked whether they had problems in registering for an SMS9-1-1 system to be identified if they used it for emergency services and the resounding answers was they would love to register their wireless devices, where do the sign up."

Network addressing is a way of uniquely identifying devices connected to networks. It may be a telephone number for the PSTN, an IP address for IP networks or a MAC address for Ethernet networks. Some network addresses are permanently assigned, others dynamically assigned. Network addressing provides a means of contacting the caller's device. For example, the Call-Back Number (CBN) provides a PSAP with a telephone number to dial in the event that the caller needs to be re-contacted. Network addressing also facilitates the automatic provisioning of location information to the PSAP. Telephone numbers make good identifiers as they are permanently assigned and unique within the network, and generally associated with users.

8.5.1 SMS Network Addressing

The SMS service, restricted to wireless service providers' networks, has an active mobile handset telephone number associated with the SMS messages that it transmits. If a short code destination is used by the subscriber, the SMS message is sent to a Short Code gateway where they are routed for processing by an Application Service Provider (ASP). Short Codes are administered by the Canadian Wireless Telecommunications Association (CWTA) and are currently restricted to be at least five digits.

In the wireless E9-1-1 voice service, a wireless cell site/sector Emergency Service Routing Digit (ESRDs) Phase I information is used to correctly route a wireless 9-1-1 call to the designated PSAP. The handset's telephone number is used by the 9-1-1 SP's ALI system to automatically query the wireless handset's Phase II location information for the serving PSAP.

Currently, the 9-1-1 SP's ALI platform and the SMS platforms are not linked and no standards exist for their interconnection, making impossible direct routing of an SMS message to the designated PSAP and automatic delivery of handset's location to the PSAP. There are two potential alternatives for addressing this obstacle until standards become available. One is to dialog through SMS via an intermediate relay operator to determine the current location of the caller and the designated PSAP. The other is to place a "silent"⁸ wireless voice 9-1-1 call and, if possible, provide an indication to the PSAP that the caller needs to communicate with the PSAP via SMS. The approximate location of the handset will be provided to the PSAP automatically in the latter case. Once the PSAP has the mobile handset telephone number by either method, the PSAP may consult the WSP's 7x24 PSAP support centre to obtain an updated location of the handset.

⁸ In the context of this Report, a "silent" call refers to the establishment of a voice connection originated on a wireless device by dialling digits 9-1-1 over which the caller does not speak. As such, the voice call is presented to the PSAP call taker as silent.

8.5.2 IM and RTT Network Addressing

IM and RTT applications are IP-based services and as such have no telephone numbers associated with their messages. Instead, they have an application-specific username, usually meaningless outside of the application's realm, which is mapped to an IP address by a central server. The service infrastructure may or may not be located in Canada. Since no active telephone number is provided and the application's username is inappropriate, the IP address may be the only usable network address, if readily available. Caller identification and location determination of IM or RTT message senders becomes difficult to achieve without proper broadband access location determination platforms and corresponding location acquisition and conveyance platforms supportable by the IM and RTT service infrastructures.

8.6 IPv4 and IPv6

IPv4 (RFC 791) is the fourth revision of the Internet Protocol (IP) that defines the internetworking methods of the internet. IPv4 is the first version to be used in the internet and it is still in use today. IPv4 is a connectionless protocol that is used on packet switched layer networks. It operates on a "best effort" delivery model and delivery, proper sequencing and no duplicate delivery is not guaranteed.

IPv6 (RFC 2460) is the next-generation Internet Protocol version that has been designated as the successor to IPv4. The main driver for the development of IPv6 has been to provide relief to the expected exhaust of IPv4 address space, within two years.

The NTWG believes that the introduction of IPv6 would affect the planning and implementation of the T9-1-1 architecture. IPv4 use a 32 bit address scheme and IPv6 uses a 128 bit address scheme. Service Providers launching any new service that uses IP should have "built in" compatibility of IPv6. Therefore, support for IPv6 addressing schemes across IP networks is a requirement for such a service to be reliable and accessible in the long term. As well, some ISPs are currently planning or implementing the roll out of IPv6 in their networks.

Some of the benefits of IPv6 are:

- Address abundance
 - IPv6's extremely large address (3.4×10^{38} addresses)
- Improved security
 - Security comes in the form of IPSec, which allows authentication, encryption, and integrity protection at the network layer.
- Integrated interoperability and mobility

- IPv6 address auto-configuration enables simple devices to achieve out of the box plug-and-play network access that is key to self-organizing networks
- IPv6 enabled applications can benefit from seamless mobility. The mobility comes in the form of Mobile IPv6, which allows devices to roam among different networks without losing their network connectivity.
- True end-to-end connectivity, enabled by the IPv6 address space and elimination of private network addresses, will allow the optimization of media-streaming applications (no need of NATing)
- Opportunity of innovation
 - Large address space could trigger innovation
 - IPv6 is designed with headroom for future growth and enhancements.

Both IPv4 and IPv6 will co-exist for some time to come and a variety of technologies are available to facilitate the migration to IPv6 and to allow co-existing IPv4 and IPv6:

- Dual stack – support of both IPv4 and IPv6 on network devices
- Tunneling – encapsulation of an IPv6 packet within an IPv4 packet for transmission over an IPv4 network
- Translation – address or port translation of addresses
- Complete IPv6 build out – a new and separate IPv6 network is created and clients are transitioned to this network over a period of time

IPv6 roll-out is at its infancy and each ISP/carrier will adopt different strategies in dealing with the eventual IPv4 resource shortage and IPv6 roll-out. Any future development and deployment of text 9-1-1 services or other 9-1-1 services utilizing IP networks would need to take into account of transition from IPv4 to IPv6 (and the co-existence of IPv4 and IPv6). This should not be considered as a “discontinuity” or impediment, and should be dealt with as part of network service planning processes.

8.7 Location Determination in Pure Text Environments

Location of the caller is a fundamental requirement for 9-1-1 calls. It is used to a) route the call/message to the designated PSAP and to b) provide the PSAP with a civic location where to send emergency services. As stated in the respective SMS, IM, and RTT sections above, either standards do not exist or appropriate platforms aren’t yet deployed for the automatic provision of location information from these text message technologies. As a result, a short term solution to the direct transmission of SMS, IM, and RTT-based

T9-1-1 messages to PSAPs would require the use of a relay centre, which must manually determine the location of the message sender in order to route the message to the designated PSAP.

Considering the above shortcomings, a number of workarounds have been identified for determining the location of a T9-1-1 call:

- By a relay centre asking the message originator using text messaging;
- If pre-registered, from the address entered in the pre-registration database. (Clearly, this address will not be valid if the communication device is moved to another location which in turn makes this solution inappropriate for mobile/nomadic text devices)
- If the caller is using (wireless) SMS, by using the telephone number associated with the SMS message and the serving WSP information to contact the WSP's 7x24 PSAP support line to determine the current wireless handset's location. (This is a manual process that the PSAPs report will take valuable time, which is not recommended by the PSAP community.)
- If the caller is using a wireless handset, by first placing a "silent" voice call to 9-1-1. The approximate location of the wireless caller will be automatically presented to the designated PSAP. The call would be "silent" and the PSAP would need some form of indicator that prompts the PSAP operator to initiate a SMS session with the caller. The PSAP, receiving a "silent" wireless 9-1-1 call and the flag indicating that the caller requires SMS 9-1-1 service, must initiate a SMS session with the caller to determine the appropriate emergency response.

Clearly, the most desirable T9-1-1 service is one that automatically routes the message for help to the designated PSAP and automatically sends the PSAP the location of the caller. PSAPs have endorsed this requirement through contribution ESCO0330.

8.8 Language Support

Although English and French are official Canadian languages (plus Inuktitut within Iqaluit), other languages may be spoken when 9-1-1 services are contacted. Often when people call 9-1-1, the stress of the situation often causes them to speak in their mother tongue. Commercial language support services are utilized by many PSAPs and 9-1-1 call relay services. When contacted, these language support services determine the language spoken then provide real-time two-way verbal translation between the caller and the PSAP.

Commercial language support services currently do not provide real-time translation services for text. There are many internet web sites that will translate text, however the name of both languages must be known prior to using the web site.

8.9 Electrical Power Supply

In order to send and receive a text message, a wireless handset's battery must have an adequate charge battery throughout the text messaging session. In order to send and receive an IM or RTT message via a device such as a Personal Computer, the device and accessories that connect it to the internet such as routers and modems must have electrical power and as such, may not operate during a power blackout if they rely on domestic electrical power. If devices such as PCs, their display terminals, routers and modems do not have an alternate source of electricity beyond domestic electrical power, then they will be affected by a power blackout.

8.10 Applicable Service Providers

SMS is a service supported exclusively by wireless carriers. IM and RTT are subscription-based, carrier-independent and over-the-top services that are carried by any carrier that support their applications through IP connectivity. Carriers supporting IP connectivity include Internet access Service Providers (ISPs) and WSPs (if the networks are properly provisioned and subscribers have the appropriate subscriptions). Note that the subscriber's service must be appropriately activated to permit the text messaging (SMS, IM, or RTT) applications. Since carrier-independent, IM and RTT services' characteristics are not influenced by the type of carrier, be it wireless or wired (i.e., xDSL or cable).

8.11 PSAP Equipment

Generally, current PSAP terminal equipment does not support SMS, IM, or RTT text messaging.

However, this does not preclude the PSAPs today from using commercially available services in order to initiate an SMS response to a 9-1-1 flagged wireless voice call from an identified DHHSI registered user. Commercially available options could include something as simple as a cell phone or blackberry with a text messaging plan in the PSAP for just such a purpose. Other options could include responding via the Wireless Carriers on-line texting service or support from a third-party "relay" agency. The use of a relay service for

responding to a T9-1-1 caller should not be confused with the recommendation to not use a relay service for the initial T9-1-1 call.

On a going forward basis the preferred but more complex solution is to have this capability integrated into a PSAP terminal or CAD equipment in order to have SMS functionality at all PSAP workstations. To achieve this end, systems will require upgrades, new equipment and/or new application software.

Currently, many primary PSAPs are equipped with TTY devices or emulation software. The 9-1-1 TTY call is answered at the primary PSAP and information is relayed verbally to the secondary PSAP. This call handling process does not offer the DHHSI caller the same level of service as a 9-1-1 voice caller since the PSAP member is required to fulfill the role of a Relay Operator to a secondary agency. It is anticipated that this practice will continue in the short term with SMS T9-1-1 service.

A long-term solution may be required for linking the SMS T9-1-1 call to the secondary PSAP. In the mean time, primary PSAPs will serve as emergency relay centres for SMS T9-1-1 calls to secondary PSAPs.

PSAPs indicate that no matter what the scale of the PSAP, lead time may be required by some PSAPs to budget, procure and commission PSAP equipment to accommodate text messaging. A potential work-around for this staggered PSAP implementation could be the use of a third party by PSAPs not equipped for T9-1-1, until their CPE has been procured and commissioned.

8.12 Traffic Considerations

NTWG Report NTRE0048 discusses traffic considerations by first establishing the baseline with the existing E9-1-1 architecture. It is recognized and acknowledged that T9-1-1 services should have comparable considerations in regard to the reliability of the networks involved in delivering the service to/from the PSAPs.

There are two versions of emergency service; Basic 9-1-1 and Enhanced 9-1-1. In the case of the former, callers are linked directly to a PSAP. The latter utilizes a designated part of the PSTN for selective routing of callers to PSAPs which are assigned according to the particular calling area, and for the provisioning of key service features. Existing E9-1-1 infrastructures are designed to provide a Grade of Service of P.01 or in some cases P.001 on trunks which carry emergency calls. Also, for robustness, networks are designed for back-up operation between paired E9-1-1 Tandem switches, and between designated Primary and Back-up PSAPs.

It is believed that the similar traffic considerations should apply where the text messaging occurs on a link that connects the caller directly to a PSAP or in the case where the caller is connected to a relay operator (IP Relay). Due to the absence of an understanding of T9-1-1 traffic characteristics and the inability to apply known voice 9-1-1 traffic metrics, the ESWG recommends that the T9-1-1 service be initially applied to only bona fide DHHSI persons. As operational knowledge for T9-1-1 improves, service expansion may be considered.

Currently SMS, IM, Chat, RTT and other text-based communication methods are available. There is no attempt in this report to assess the respective merits of the different text messaging methods, except to note that it has been stated that Real Time Text RTT is the only form that is considered to be conversational.

Several different access configurations are likely to continue to be employed for providing 9-1-1 service, depending on the nature of the responsible service provider (ILEC, CLEC, Local Reseller, WSP, VoIP SP, etc.). In the circumstances, and absent the adoption of Reference 9-1-1 Architecture, traffic considerations for text messaging can only be addressed qualitatively at this time.

The main objective of the 9-1-1 service is to ensure that any caller requiring urgent assistance can quickly reach the emergency service agency that is best able to respond (e.g. fire, police, ambulance, poison control, etc.). The legacy 9-1-1 network is designed with special features and capabilities to attain that objective, including an elevated Grade of Service (P.01 or P.001) on trunks that carry emergency calls between the serving end office and the paired 9-1-1 Tandem switches. These dedicated 9-1-1 trunks and the Tandem switches are also pair-configured, each 9-1-1 trunk/Tandem switch serving as back-up for the other.

Matching capabilities ought to be given access to arrangements that carry 9-1-1 text messages, adequate for attainment of a similar level of performance in an IP environment, and in consideration of the particular form of text messaging involved.

The objective should be to provide as near real-time flow of information as possible to make text communication almost equivalent to what normal voice service is for hearing persons.

Given current network configurations, SMS emergency messages will not receive any sort of “priority treatment”. SMS does not provide “priority handling” at the radio interface or on the network. SMS messages always contend with other traffic on the radio control channels, both voice and messaging. ~~Voice calls always have priority over SMS. There will likely be delays in the origination and delivery of SMS messages at the radio interface.~~

Towards that end, network infrastructures that are intended to support text messaging for 9-1-1 services must be designed to minimize latency, and delays due to buffering of text. This requirement will be of particular relevance for situations where text messages are expected to traverse intermediate network(s) before arriving at their destination. Suffice it to say that 9-1-1 text messages will need to be afforded priority treatment. However, no standards exist for the prioritization of T9-1-1 traffic. A work-around may be the above provisioning of equipment to minimize latency and delay.

9-1-1 text messaging may initially occur via relay services, as opposed to direct connection to a PSAP. This hints that, in the main, 9-1-1 message communication will be provided as a component of a general relay service, analogous to basic voice service. Therefore, network designers should avoid the temptation to size IP access arrangements on the basis of experience with the deployment of legacy TTY systems. It is reasonable to assume that migration from a TTY-type relay service to one utilizing a text-based communication system will result in significant increase in traffic. Hearing-impaired and speech-impaired persons need to communicate not only with others who are similarly challenged, but also with hearing and speech-capable persons. The user-unfriendly nature of antiquated TTY systems makes for their limited use, no doubt. A text-based system will stimulate usage to an extent that is likely to make traffic modelling based on legacy TTY-based relay service improper and inadequate.

It has been stated by the NTWG that it would be prudent for service providers to consider initially restricting their offerings of text messaging services to those who cannot communicate clearly via a voice call, until proper engineering studies can be undertaken with a view to developing and implementing techniques/practices for removing the potential for adverse impact to 9-1-1 text-based traffic from mass general traffic.

Hearing persons have an array of communication systems available to them – voice telephony, SMS, IM, Chat, etc. The form of communication selected for use at any time is largely based on the preference of the hearing users.

The result should be to provide hearing-impaired and speech-impaired persons with a communication system that is as near conversational as possible, i.e. the same as that afforded by voice for hearing persons, with no consideration for providing the same service to hearing users at this time.

This selective offering can be administered through a pre-registration process, as is currently done in the UK. Pre-registration, incidentally, caters to the need for associating a caller with a location address – the equivalent of the ANI/ALI relationship of the legacy 9-1-1 service.

Traffic considerations for 9-1-1 text messaging must be adequate to the need for ensuring that 9-1-1 service features and capabilities are adequately served in an IP environment.

In Canada there are approximately 3 million persons that are Hard of Hearing (HoH) and another 200,000-300,000 persons with speech impairments (SI). This is approximately 10% of the Canadian population. Approximately one-half of 9-1-1 calls today are wireless. A crude, straight-line approximation would yield that if the T9-1-1 service is launched in the manner proposed, that the T9-1-1 traffic created by the DHHSI community would become approximately 5 to 10% of the current level of 9-1-1 calls today. Again, these estimates are very crude and emphasize the need for a technical trial and controlled launch. The service should be confined to the DHHSI community to verify traffic estimates and operational requirements. Current TTY traffic statistics are not a good proxy due to the diminishing popularity of TTY within the DHHSI community.

9 T9-1-1 Solutions

9.1 TTY Emulation on Wireless Smartphones

TTY technology is explained in section 6.1 above.

9.1.1 Description

TTY Emulation on a wireless smartphone is achieved by loading commercially available software onto a wireless smartphone that has a QWERTY keyboard. The smartphone then emulates a TTY/TDD device (see section 6.1) in sending text messages via Frequency Shift Keying (FSK) over a voice channel, as a regular TTY device would.

References: ESCO0327, ESCO0328

9.1.2 Analysis

TTY emulation on a wireless smartphone would enable the user to dial 9-1-1 with the use of a QWERTY keyboard, similar to that of a TTY/TDD. By using a voice channel, the wireless phase I or II E9-1-1 features would operate normally. As a result, the 9-1-1 call would be routed to the designated PSAP and the PSAP would receive wireless location information. Most PSAPs have TTY devices or TTY emulation.

The shortcomings with this capability are as follows:

- some PSAPs do not have TTY capability;
- The TTY emulation software is not commercially available for wireless handsets.

9.1.3 Recommendation

Although this T9-1-1 model offers the advantage of automatic call routing and provision of Call Back Number (CBN) and location of the handset, the TTY emulation software is not commercially available. Therefore, TTY emulation on wireless smartphones is **not recommended** at this time as a solution for T9-1-1.

9.2 Short Message Service (SMS) Solutions

SMS technology is explained in section 6.2 above.

9.2.1 General Description of SMS Solutions

As pointed out earlier in this Report, SMS bears the most promising hopes in regards to providing T9-1-1 service in the current environment. Consequently, several solutions and approaches have been proposed and assessed for which recommendations are provided. Those solutions are as follows:

Section 9.2.4 explores a solution via SMS short code.

Section 9.2.5 explores a solution proposed by Positron Public Safety Systems.

Section 9.2.6 explores a solution via a relay centre.

Section 9.2.7 explores a solution using a “silent” wireless 9-1-1 call.

9.2.2 General Analysis of SMS Solutions

The four SMS solutions described above has been assessed. The results highlight that all solutions will require architecture development and/or standards work. The analysis has demonstrated that one solution may be feasible.

It is expected that this service would apply to Canadian wireless handsets registered in their home networks, or registered and roaming onto a Canadian WSP. As this service

likely requires an activation process, it is expected that US and international roamers could not use this service.

9.2.3 General Recommendation on SMS Solutions

Based on the assessment of the three SMS solutions described hereinafter, the ESWG recommends that the solution using a silent wireless 9-1-1 call to reach the PSAP be further assessed and that proof of concept trials be planned. There are three major areas of the solution that need further investigation:

1. What will be the SMS T9-1-1 subscription process;
2. How to provide a timely indicator to the PSAP that the incoming silent wireless call requires SMS T9-1-1 message treatment;
3. If the timely indicator requires it, how the SMS T9-1-1 TNs will be populated and maintain up to date in the ALIs.

9.2.4 SMS Short Code Access Method

Description

This access solution uses a SMS short code such as “91100” (minimum 5 digits) to access the SMS to 9-1-1 service. Short codes are used by the wireless industry to facilitate the addressing of SMS text messages (see section 6.2). Calls using this short code string need to be routed to the designated PSAP as in the case of wireless Phase I or II calls, but would indicate to the PSAP that the caller requires a SMS response.

Analysis

This solution sounds eloquent however would require costly and time-consuming development on the WSPs’ Mobile Switching Centre (MSC) software. Also, development would be required within the ALI platforms to recognize the call was received via a unique access code and to transport that indication to the PSAP CAD systems.

Recommendation

Due to the time and cost of implementing this access method, it is not recommended as an access method for SMS T9-1-1.

9.2.5 Positron Public Safety Systems Canadian Proposal

This proposal by Positron provides recommendations for establishing a Canadian Wireless T9-1-1 framework based strongly on the Blackhawk County Trial. Positron Public Safety Systems, a subsidiary of Intrado, works with end-to-end public safety solutions for call handling and dispatching.

9.2.5.1 Description

There is an expectation by subscribers that they may make a 9-1-1 call via text as against voice. The types of users include:

- Hearing/speech impaired
- Younger people who assume that it is possible to reach 9-1-1 via text
- People in situations where they are not in a position to speak; should they be overheard their life may be in danger.

Note: the ESWG has recommended that the initial T9-1-1 service be confined to the DHHSI community.

The objective of the service will be to offer a national text 9-1-1 service irrespective of where the caller is located in Canada, in which PSAP jurisdiction the caller makes the text or which Carrier they subscribe to. In addition, Positron recognises that the service must be able to:

- Route all text messages to the PSAP within whose jurisdiction the caller is texting based on the cell sector – similar to Phase I routing for voice calls
- To be able to deliver the cell sector location display to the PSAP in combination with the initial text message
- To be able to support all legacy handset devices that can support SMS messages
- To be able to obtain text caller location (cell sector) information over standard idle mode interfaces, for example IS881/IS801 and MAP ATI
- For every PSAP to have terminal access to text messages; these messages to be combined with the normal voice call stream or where this is not possible, to have access to text messages from a separate application
- To support a text conversation between the PSAP and text caller with as many text messages as required

- To support a multi-language capability i.e. for the delivery system to be agnostic to the language which the texting parties – caller and PSAP - are using
- To limit the level of text intentional and unintentional (e.g. pocket 9-1-1) nuisance calls to 9-1-1.

Information provided by Positron also makes proposals on how the above service attributes could be implemented and in particular the need for the CISC ESWG to establish a new standard interface in Canada for the support of text conversations between WSP networks and the 9-1-1 SPs/PSAPs.

Excluded from this proposal are the issues of unregistered phones, international roamers and prepaid phones whose accounts are suspended preventing them from making or receiving text calls.

High Level Text to PSAP Architecture

The high level T9-1-1 architecture proposed is shown in Figure 8. It is assumed that the WSP SMSC gateway will be connected via SMPP to a new Text Emergency Routing Function (TERF) node. This node will have the capability to store and forward a text message to the PSAP in whose jurisdiction the caller is texting – this will require a cell sector to PSAP database to be maintained. It should be noted that the TERF will require access to this PSAP routing database as well as the street address of each of the cell sectors.

To determine the location of the caller, the TERF will send a TCAP location query to the HLR 'A interface' (MAP ATI for GSM networks) and HLR/MSC VLR 'A/B interfaces' (IS881/IS801 for CDMA networks). The HLR/MSC response message will include MSC identifier and current registered cell sector.

Figure 8. Positron SMS T9-1-1 Proposed Architecture

The interface between the WSP and the 9-1-1 SP, the C interface in figure 8, will need to be defined and standardised by the ESWG in a similar fashion to the manner that the MLP interface was in support for E9-1-1 Phase II implementation. The 'C' interface should support the following functions:

- Route to the designated PSAP,
- Establish a unique session for each text conversation
- Manage the transfer of text message sessions between the PSAP and TERF entities for as many messages as required by the calling and PSAP parties
- Be agnostic to the language used in the text message

A key requirement noted above is one of service ubiquity i.e. the ability of all PSAPs to be able to receive text messages and, when appropriate, establish a bi-directional text dialogue with the caller. Two means of providing text connectivity to the PSAP are necessary to achieve a universal deployment of a text solution in minimal time:

- For PSAPs supporting Next Generation Customer Premise Equipment (NG CPE): an additional application be deployed that can support the 'C' interface and display the text dialogue and caller location information to the PSAP call taker in an integrated fashion with voice 9-1-1 calls

- For PSAPs that do not have NG CPE (Legacy PSAPs): to enable a separate application to the text message stream to be deployed at the PSAP. This solution would be segregated from voice 9-1-1 queues.

Delivering text messages directly to the PSAP rather than through a relay centre would enable call takers to be able to converse with several text callers at once.

Routing Based on Cell Sector

Text messages are routed to PSAPs based on the Cell Sector from which the caller is texting, i.e., similar to Phase I voice functionality. In the vast majority of cases the PSAP routing will accurately reflect the PSAP jurisdiction for the caller and is consistent with the manner in which voice 9-1-1 calls are routed.

Information Associated with the 'A' Interface

The information that will need to be sent between the TERF and the PSAP application to set up a text session and display this information at the PSAP are:

- Caller identifier (MDN)
- Caller location (Serving MSC ID, Cell Sector Identifier, Cell sector street address, etc)
- Caller and PSAP text message content
- PSAP identifier/address and related routing information (primary route, alternate, transfer, etc)
- Unique session identifier for logging and historical purposes

Service Reliability – use of 9-1-1 SMS-C

To improve the reliability and performance characteristics of a commercial SMS-C network, a separate 9-1-1 SMS-C gateway should be introduced. This is recommended so that the configuration of the 9-1-1 SMS-C can be set to better serve the unique properties of 9-1-1 texting.

9.2.5.2 Analysis

- Positron did not present the contribution that described this proposal first-hand. Therefore, there are many unanswered questions about this proposed solution.

- The access method is not clear. It is assumed that the user initiates the process by sending a text message to a SMS short code.
- New platforms are required, such as the 9-1-1 SMS-C and the Text Emergency Routing Function (TERF) nodes. The introduction of new platforms will generate a longer “preparation to launch” interval.
- Any new network platforms should conform to existing open industry standards. It is not known if the new platforms conform to existing open industry standards.
- WSPs may not allow direct access to their HLRs, which is a key functional platform within each WSPs’ network, for network integrity reasons related to public held corporation legislation such as Sarbanes-Oxley (“SOX”).
- The ability of this architecture to provide wireless Phase II E9-1-1 location information must be confirmed.
- Any new interface will require standards development and approval, which typically takes several years.
- PSAPs will be required to upgrade their equipment to be compatible with the “C” interface, or use an intermediary service.
- The solution appears to have characteristics of a NG9-1-1 solution and therefore may be a form of a long-term solution.

9.2.5.3 Recommendations

Based upon the above analysis, the proposed Positron solution may have merit as a long-term solution once the suggested new platform and network security issues have been clarified and resolved.

9.2.6 SMS T9-1-1 Via a Relay Centre Solution

9.2.6.1 Description

A service model was examined whereby a national or regional text relay centre, similar to a Voice over IP (VoIP) 9-1-1 relay centre that would support the SMS to 9-1-1 service. The DHHSI user would send a SMS message using a short code, e.g. 91100 (minimum of 5 digits). The short code ASP is a gateway connecting the WSPs' SMS-Cs to the relay centres. The short code ASP would forward the text messages to a national or regional text relay centre. The text relay centre would respond to the DHHSI user and determine the designated PSAP manually and act as a two-way "translator" between the SMS messenger and the PSAP.

Reference: ESWG TIF 61 notes.

9.2.6.2 Analysis

Design Considerations

- In any SMS T9-1-1 solution, the key objective is to get the text message to the designated PSAP as quickly as possible. The mobile handset location must be determined to identify the designated PSAP. The nature of the emergency then must be provided verbally to the PSAP call taker.
- The SMS T9-1-1 solution should also permit 2-way messaging between the message sender and the PSAP in order to permit information clarification and confirmation. (All messages from the same mobile handset must be managed by the same SMS to 9-1-1 message taker during the incident).
- If a call centre is used to relay SMS to 9-1-1 text messages, the Zero minus Emergency Call Routing Service (0-ECRS) offered by ILECs may be utilized to route information to the designated PSAP, once the location of the mobile handset is determined. Note: PSAPs have indicated in ESCO0330 that calls forwarded by using the 0-ECRS service occasionally are routed to non-emergency PBX lines at PSAPs, resulting in a lower level of service for these emergency calls.
- The WSP that provides service to the mobile handset must be known, if the WSP's 7x24 PSAP support line is to be consulted by the PSAP to obtain the current location of the mobile handset. The WSP information could be provided by the SMS Short Code ASP.
- Should pre-registration (wireless handset Telephone Number, name, address, and WSP) be required or optional? In the UK, the Ofcom

method requires SMS to 9-1-1 users to pre-register on a web site, so that the texting party is clearly identified.

- PSAPs indicate that a long lead time is required to upgrade PSAP equipment to accommodate SMS to 9-1-1 messages. Some PSAPs do not receive equipment upgrades as frequently as others, making them more reliant on interim measures.
- Standard interfaces must be specified to facilitate infrastructure acquisition and interconnections.

National Relay Centre Requirements

- The National Relay Centre (NRC) must be capable of receiving SMS to 9-1-1 text messages, determine the correct address through interchanging text messages with the message originator, determine the designated PSAP and remain on line and act as a relay service between the PSAP (voice) and the message originator (SMS).
- The NRC must be supported by at least one backup relay centre, in the event of building evacuations or local emergencies, etc. Backup power and other critical systems similar to those in a PSAP will likely be required.
- The NRC must record all text messages sent between the message originator and the NRC for subsequent forwarding to the designated PSAP.

Advantages

- This service could be quickly implemented, i.e. potentially within a year of once ownership and funding issues have been addressed.
- This service would function with all existing PSAPs in their current configuration. In other words, apart from training on the use of this service, PSAPs would not require any new equipment or text messaging procedures.

Disadvantages

- The call is not routed automatically to the designated PSAP.
- The caller's location is not automatically provided to the PSAP.
- The introduction of a manual intermediary process will inherently add delay in processing the emergency call at the PSAP.

- The relay centre uses the 0-ECRS service, which the PSAPs have indicated in ESCO0330 that emergency calls are sometimes routed to non-emergency PBX lines at PSAPs, resulting in a lower level of service.
- National Relay Centre capital and operational costs require resolution.
- PSAPs observe that “short term” solutions occasionally are kept in service longer than originally intended.

9.2.6.3 Recommendation

The Relay Centre solution has major disadvantages, i.e. incoming SMS messages from a caller are not automatically routed to the designated PSAP and the location is not automatically provided to the relay centre or PSAP. However, a relay centre may be utilized for outbound SMS messages from a responding PSAP that does not have infrastructure to support SMS or if its SMS infrastructure is not available.

9.2.7 SMS T9-1-1 via Silent Wireless Voice Call

9.2.7.1 Description

This method of accessing 9-1-1 via SMS leverages the existing wireless voice E9-1-1 calling capabilities to the maximum extent technically possible. To comply with this Report’s recommendation to confine the SMS T9-1-1 service to the DHHSI community, the solution proposes pre-registration for the service, possibly via a web site on the internet or through the WSPs’ customer service infrastructures. This pre-registration facilitates an indicator for the PSAP receiving a silent wireless 9-1-1 voice call that the caller requires communication via SMS. A service is required to download and keep up to date the registered TNs in all Canadian ALI systems irrespective of the WSP’s geographical serving area.

The high level call model is as follows:

- A pre-registered caller dials 9-1-1 in the manner similar to a regular voice call from a wireless handset capable of both SMS messaging and voice calls.

- The 9-1-1 call is routed automatically to the designated PSAP via the wireless E9-1-1 Phase I service, providing the CBN and the Phase I location information to the PSAP.
- If the PSAP has wireless E9-1-1 Phase II capability, then the current location (Latitude, Longitude, Uncertainty and Confidence) of the wireless handset is automatically provided to the PSAP.
- The PSAP operator, receiving a “silent” wireless 9-1-1 call, will also receive a visual indication that the caller has registered with the SMS-to-9-1-1 service and requires 9-1-1 service via SMS messaging.
- The PSAP operator then originates and transmits SMS messages to the mobile handset indicated by the CBN.
- Text messages are exchanged as required to determine the nature of the emergency and other required information to determine the emergency service response.

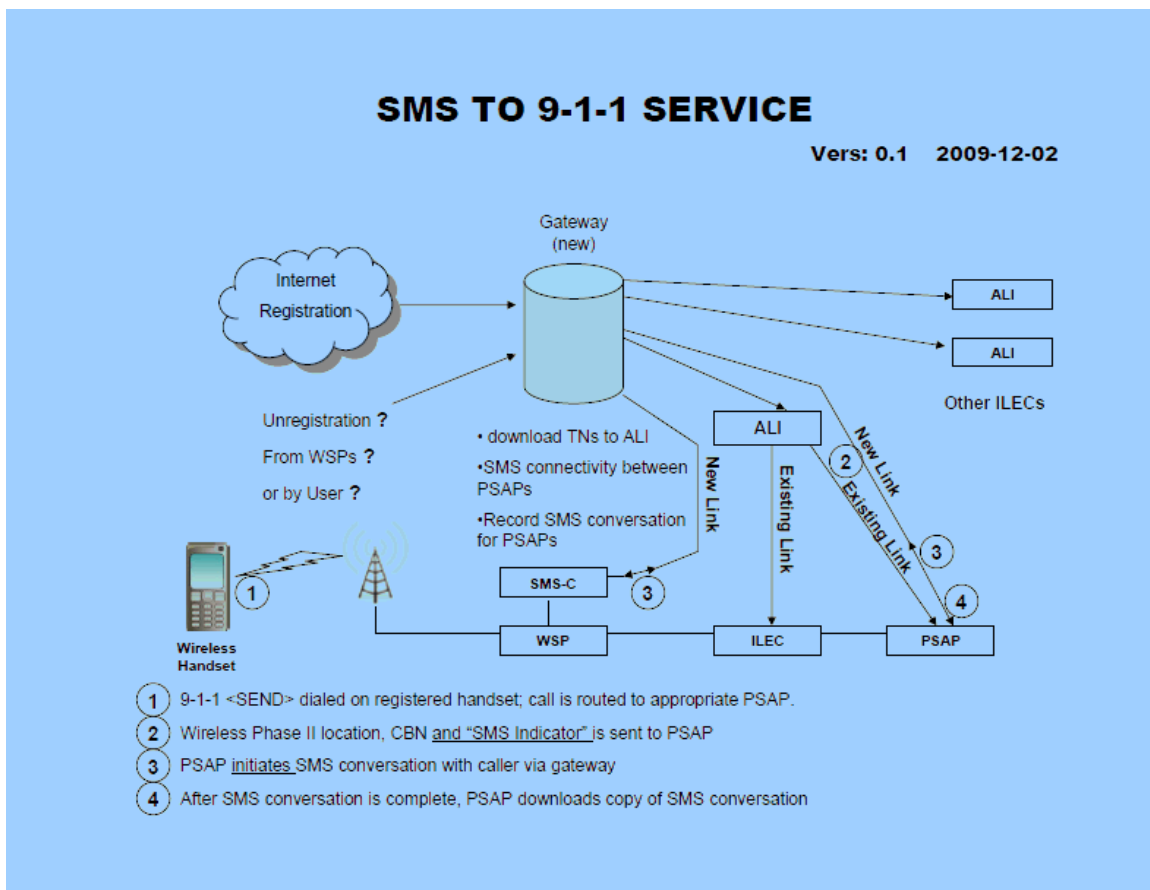


Figure 9. SMS T9-1-1 Call Preceded by a “Silent” Voice Call

A specialized gateway function is required between the PSAPs and the WSPs' SMS-Cs. Some of the functions include:

- a) IP interface toward the PSAP
- b) The ability of providing remote access via console, client software or web page to the PSAP/agent
- c) The ability to select the Home carriers SMS-C
- d) Provide the user the means of SMS termination to a given CBN
- e) Allows continuous dialogue between the SMS mobile user and the PSAP/agent
- f) Ensure that the reply addresses (dialogue identity) cannot be reused, has to be unique and aged once used
- g) Provide a means by which the PSAP may obtain a transcript of the entire SMS-to-9-1-1 call.

Reference: ESCO0326

9.2.7.2 Analysis

This model service utilizes as much existing infrastructure as possible, to reduce time to implementation. As this involves SMS which is available only from WSPs, the service is restricted to mobile subscribers. Rather than providing basic 9-1-1 service manually through an intermediate operator, the subscriber receives enhanced 9-1-1 service, i.e. the call is automatically routed to the designated PSAP and the PSAP (if equipped for wireless Phase II E9-1-1) will automatically receive call-back number (CBN), Phase I location and subsequently the geographic phase II location (Longitude, Latitude, Uncertainty and Confidence) of the caller as any wireless voice 9-1-1 call.

PSAPs receive silent 9-1-1 calls on a regular basis. An indicator is required to instruct the PSAP operator that a SMS response is required. Several options were investigated to resolve this issue, as described in the following sub-sections.

PSAPs require a means to send SMS messages to the SMS 9-1-1 caller. This may be achieved through implementation of a new network platform “gateway” with the functionality listed above along with PSAP CPE upgrades. Implementation of a network a platform will require months of design specification and commercial arrangements. Alternatively, a PSAP may simply use a wireless handset to respond to SMS 9-1-1 calls.

9.2.7.3 Methods of Indicating to PSAP that a SMS Response is Required

9.2.7.3.1 PSAP Lookup National Database

Description

In this scenario, a PSAP operator receives a silent wireless E9-1-1 call and no other indication. The PSAP operator checks the callback number against the national database of DHHSI users to determine if the silent 9-1-1 caller requires a SMS response.

Reference: ESCO0333

Analysis

Although simple, this method requires a manual check by the PSAP operator for all silent wireless E9-1-1 calls, which adds unwanted time to the 9-1-1 call handling process and introduces the potential for human error.

Recommendation

This method is not recommended.

9.2.7.3.2 Reverse ALI

Description

In this scenario, a PSAP operator receives a silent wireless E9-1-1 call and no other indication. The PSAP operator performs a “reverse ALI” check on the callback number. If the silent caller is a DHHSI person that requires a SMS response, the reverse ALI response will indicate that. This method requires the national database to download the registered DHHSI telephone numbers to each ALI platform.

Reference: ESCO0333

Analysis

This method requires a manual check by the PSAP operator for all silent wireless E9-1-1 calls, which adds unwanted time to the 9-1-1 call handling process and introduces the potential for human error.

Recommendation

Considering this solution has dependency over the enhancement or replacement of E9-1-1 networks to support the Reverse ALI feature and due to the delays it would introduce at the PSAP to properly handle such calls, it is not recommended as a SMS T9-1-1 solution at this time.

9.2.7.3.3 TN Pre-Registration Method

Description

With this solution, a new process would be required to manage registration of DHHSI community members to this SMS T9-1-1 service. This process would download the telephone numbers of users of the SMS T9-1-1 service to each ALI databases in Canada, potentially through the existing 9-1-1 SPs TN records update process. The process must also support un-registration as well as tracking wireless service activation/de-activation and wireless number portability, all of which to be reflected in a timely fashion in the ALI databases.

Providing the above process and upon the reception of the wireless 9-1-1 call, the ALI would lookup for the ESRD to determine if Wireless Phase II service is available. It would also lookup for the CBN to find a matching entry for a DHHSI TN. If matching is successful, the ALI would provide some kind of indicator in the first ALI display to the PSAP to highlight this silent wireless 9-1-1 call requires SMS T9-1-1 service.

Reference: ESCO0333

Analysis

To enable this solution the following must be addressed:

- The SMS T9-1-1 registration process must be defined;
- The process and architecture required to keep wireless service and SMS T9-1-1 registrations current and up to date must be defined;
- The process and architecture required to upload and maintain up to date the SMS T9-1-1 TN records in all Canadian ALI systems must be defined;
- The 9-1-1 SPs' ALI platforms require modifications to determine if a wireless 9-1-1 caller is registered to the SMS T9-1-1 service by performing lookups for both the ESRD and the CBN;

- The method by which the DHHSI indicator will be supplied to the PSAP must be defined by each respective 9-1-1 SP;
- The integration of the DHHSI indicator with the delivery of Wireless E9-1-1 Phase II must be assessed by each respective 9-1-1 SP;
- The impacts on performance, hardware and software resources of the ALI systems must be assessed by each respective 9-1-1 SP.

Recommendation

A **more detailed assessment** of the feasibility, cost, and time to implement the platform and ALI changes is required.

9.2.7.3.4 Abbreviated Dialling Code Method

Description

This solution uses an abbreviated dialling digit string such as 9XX (other than 9-1-1) or a * or # code such as #911 to access the SMS to 9-1-1 service. Calls using this abbreviated digit string would be routed to the designated PSAP as in the case of wireless Phase I or II calls, but would indicate to the PSAP that the caller requires a SMS response.

Analysis

This solution sounds eloquent however would require costly and time-consuming development on the WSPs' Mobile Switching Centre (MSC) software to enable the call routing. Also, development would be required within the 9-1-1 SPs' voice and data infrastructures to recognize the call was received via a unique access code and to transport that indication to the PSAP CAD systems.

Recommendation

Due to the time and cost of implementing this access method, it is not recommended as an access method for SMS T9-1-1.

9.2.7.3.5 Unique Area Code Method

Description

In the North American Numbering Plan (NANP), the format of a telephone number is NPA-NXX-XXXX where the NPA is the Numbering Plan Area or area code, the NXX is the Central Office or CO code, and the trailing XXXX is the station number. Instead of pre-registering the wireless handset's telephone number on a central database, the wireless handset is assigned a telephone number from a unique area code, such as a 5XX or 6YY Service Access Code (SAC). Telephone numbers from this Number Plan Area (NPA) would be assigned only to the wireless devices of DHHSI users. In this case, when a DHHSI person requires 9-1-1 assistance, they dial 9-1-1 as if they were making a voice to 9-1-1 call. The call will automatically be routed to the designated PSAP and the PSAP will receive location information associated with the wireless device. The unique NPA on the Call Back Number (CBN) and optional PSAP display screen information will indicate to the 9-1-1 operator that the caller requires a response via SMS. Implementation of the unique NPA would bypass the need for ALI development for identifying DHHSI users for PSAPs.

Initial discussions on this unique NPA concept were held between some NTWG, CSCN, and BPWG members and Canadian Numbering Administrator (CNA) staff. This assignment of a NPA in this manner is unusual and would therefore require special consideration by the CSCN for CISC and perhaps consideration by the North American Industry Numbering Committee (INC) for NANPA. Such a process would take at least 6 months.

Analysis

This method would bypass the need to register DHHSI handsets' TNs, i.e. it would bypass the need of a platform and web site to register the handsets' TNs and the need to modify ALI systems. Special procedures would have to be developed by WSPs to provide DHHSI persons' handsets with the unique NPA. PSAPs may require the screening of incoming call-back numbers (CBNs) to detect the unique area code and to display a corresponding message to the PSAP operator.

If the assignment of the special NPA is permitted, the following must be considered and decided upon by the appropriate CISC committees:

- a) Would the DHHSI community be opposed to requiring a special area code for their wireless devices?
- b) What is the geographical footprint of the NPA? (Canada is assumed.)

c) Should the telephone numbers within this special NPA permit 2-way voice conversation? It is assumed yes, which will drive considerations listed below.

d) Updates to the Assignment guidelines of the NPA-NXXs would be required. This task would have to be undertaken by the CSCN.

e) Should the NXXs be assigned to specific urban areas to prevent the NPA from exhausting? How many urban areas across Canada should receive assignments? Perhaps the NPA-NXXs should be assigned only within the largest 20-30 urban areas to prevent NPA exhaust. This assignment method would not have an impact on "data only" DHHSI users that may need the voice mode of the smartphone to dial 9-1-1.

f) A NPA exhaust plan is required. Currently, a NPA has approximately 8,000,000 telephone numbers (or approximately 800 NXXs), which could service the estimated 3,500,000 DHHSI persons. However, the NPA-NXXs, if assigned on a WSP and major city basis, may lead to "stranded" unassigned telephone numbers in some urban areas which would contribute to NPA exhaust. What would be the assignment method in areas that do not receive unique number assignments?

g) Consumer education requirements, such as voice calls other than 9-1-1 triggering long distance charges.

h) If toll charges are waived, what methods can carriers implement to preventing fraud?

i) Should the numbers be portable? Currently telephone numbers from NPAs 5YY and 6XX are not portable. If porting is permitted, do any porting rules get impacted by this service architecture? What are the impacts for NPAC and the current LNP Processes? The CLNPC, Neustar and the CISC BPWG would need to be consulted.

j) What, if any, impacts would there be for IXC and toll carriers? Are their systems capable of handling a SAC for this purpose?

If the issues could be resolved by CISC committees, then this solution could become a means of indicating to PSAPs that the caller requires a SMS response.

Recommendation

This method of "flagging" a DHHSI caller to a PSAP should be evaluated in detail with the other alternatives to determine the least-cost and expedient solution.

9.2.7.3.6 Unique Central Office Code Method

Description

In the North American Numbering Plan (NANP), the format of a telephone number is NPA-NXX-XXXX where the NPA is the Numbering Plan Area or area code, the NXX is the Central Office or CO code, and the trailing XXXX is the station number. This method utilizes unique Central Office Codes within each ILEC telephone exchange to identify DHHSI subscribers. The CO codes must initially be unassigned. It was proposed that the format of the CO code be changed from NXX to XXX, i.e. instead of the first digit being restricted to the number range 2 to 9, the range be opened up to include 0 or 1, and the 0 or 1 be used to indicate a DHHSI CO Code.

Reference: ESCO0334

Analysis

- The unique CO code could be assigned with existing systems, with respect for WSP IT development to keep them confined to DHHSI persons.
- The initial implementation of this method would create a huge demand for new central office codes by each WSP within each NPA, which may drive some NPAs into relief planning and perhaps jeopardy situations (refer to “NPA relief planning” in the Canadian Numbering Administrator Web site: http://www.cnac.ca/npa_codes/relief/overview.htm).
- Changing the format of a CO code away from the existing NXX format would be a costly and long process that would involve North American standards and guideline changes, including changes in jurisdictions other than Canada, and would require software changes in all existing telecom switching systems.
- PSAPs may require the screening of incoming call-back numbers (CBNs) to detect the CO code and to display a corresponding message to the PSAP operator.

Recommendation

- Changing the format of a NXX is not recommended due to the time line, cost, and dependency on non-Canadian jurisdictions.
- The unique CO code solution may be a feasible alternative as a method of flagging a DHHSI user; however an analysis on the potential impact on NPA exhaust is required prior to further consideration of this proposal.

9.2.7.3.7 Wireless Subscriber Information (WSI) Indicator

Description

This method entails the provisioning of a DHHSI flag with a subscriber's telephone number. When the subscriber dials 9-1-1, the call proceeds as a normal wireless Phase II 9-1-1 call, except when the ALI platform “pulls” the location information (Latitude, Longitude, confidence, and uncertainty information) from the appropriate WSP, the WSI indicator is also “pulled” and processed by the ALI platform. The DHHSI information (WSI indicator) would be assigned when the subscriber adds or changes a wireless subscription. The ALI would need to present the DHHSI information to the PSAP operator.

Analysis

This method would bypass the need for capturing the TN in a database and the need for a unique area code or access method.

This method would require development of the WSI parameter, i.e. standards development and implementation on the following platforms: WSP activation/deactivation, HLR, MSC, VLR, and GMLC/MPC. Also, the wireless MAP and ANSI-41 protocols and MLP protocol would require standards modification and implementation.

Recommendation

This method would be a transparent solution to the DHHSI user however extensive changes to WSP networks would be required. As a result, this method is not recommended.

9.2.8 Long-Term SMS T9-1-1 Solution

The Next Generation 9-1-1 (NG9-1-1) involves a homogeneous IP network, including IP access to PSAPs and an expansion of PSAP access mechanisms, such as automatic collision reporting. This dramatic evolution of PSAP equipment will be a gradual process and is expected to take place in the order of 10 years.

It is recommended that the ESWG monitor NG9-1-1 evolution and as IP and NG9-1-1 technology matures, that the ESWG consider introducing the technology in 9-1-1 call processing and PSAP environments via established CISC processes.

10 Next Generation 9-1-1 (NG9-1-1)

The evolution of emergency calling beyond the traditional voice 9-1-1 call has caused the recognition that current E9-1-1 systems may no longer be able to support the needs of the future. Today's 9-1-1 system is being challenged by emerging technologies.

The existing narrowband, circuit switched 9-1-1 networks carry only voice and very limited data. Currently there are difficulties in supporting such 9-1-1 services as text messages, building floor plans, medical information and video for emergencies if deemed required. This potential shortfall triggers the creation of a more flexible emergency 9-1-1 system design with much greater data handling capabilities. A highly standardized system is essential to support communications across provincial borders and the multitude of emergency response agencies, from traditional PSAPs to Health Centres and disaster management centres. This new system is Next Generation 9-1-1 (NG9-1-1).

There will be numerous and varied steps toward getting to this NG9-1-1. Vendors are already starting to produce NG9-1-1 oriented products. The direction of the standards that will support NG9-1-1 is becoming clear, and demonstrations and trials are beginning to appear. Despite this progress, a fully featured NG9-1-1 system is not yet identifiable because the necessary standards are still in development.

NG9-1-1 is anticipated to meet the following objectives:

- a) enable E9-1-1 calls from any communications device;

- b) enable a flexible, open, non-proprietary and secure architecture; coordinate standards and interoperability;
- c) maximize operating and maintenance cost savings;
- d) reduce capital expenditures;
- e) provide additional information to PSAPs;
- f) enable geographic independent call access, transfer, and back-up between PSAPs and other emergency organizations;
- g) make routing decisions at the time of the call based on most up-to-date location information; and meet NENA i2 and i3 standards.

These objectives, if met, will ensure the ultimate goal of NG9-1-1 which is to improve the effectiveness of the emergency communications system and enhance public safety.

Next Generation design uses IP technology to achieve flexibility, geographic independence, and interoperability. Routing decisions are made dynamically at the time of the call based on automatically updated location information. Supporting all current and emerging technologies, NG design facilitates the easy transfer and back-up of calls between PSAPs.

10.1 NG9-1-1 Summary Definition

NG9-1-1 is a system comprised of hardware, software, data and operational policies and procedures to:

- provide standardized interfaces from call and message services
- process all types of emergency calls including non-voice (multimedia) messages
- acquire and integrate additional data useful to call routing and handling
- deliver the calls/messages and data to the designated PSAPs and other appropriate emergency entities
- support data and communications needs for coordinated incident response and management
- provide a secure environment for emergency communications

10.2 NG9-1-1 Architecture

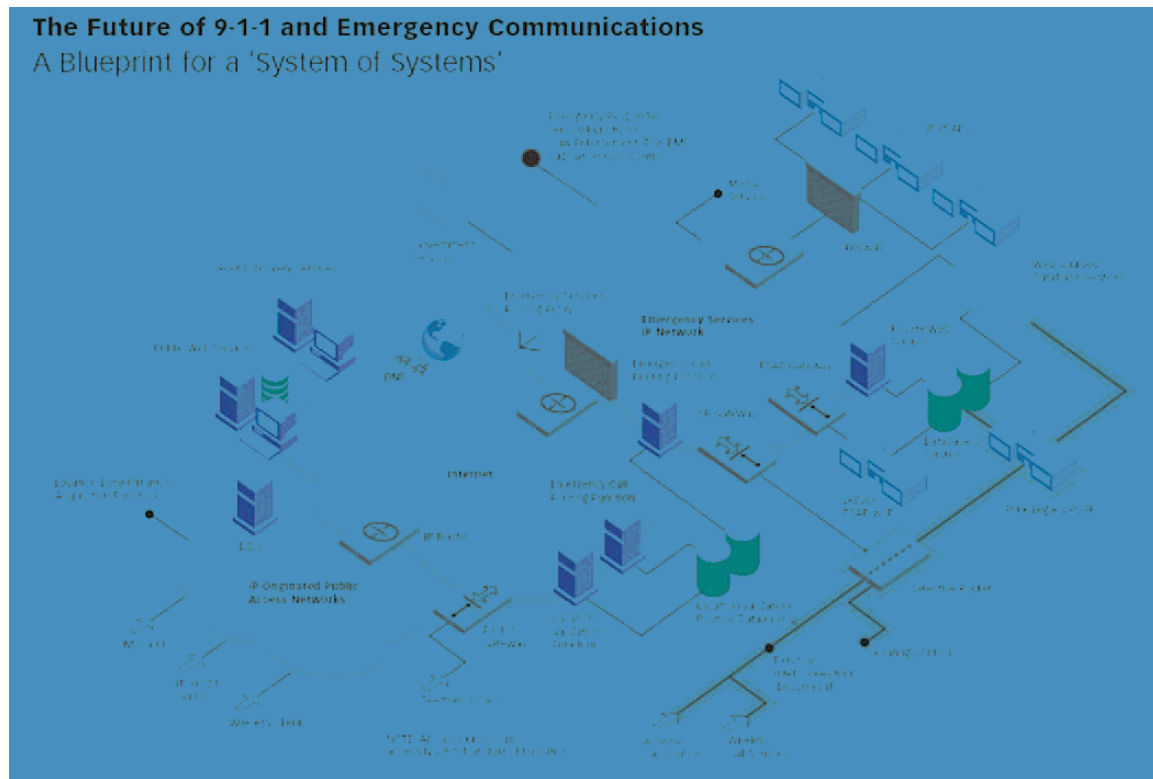


Figure10. NG9-1-1 architecture

Proposed by the National Emergency Number Association (NENA), Internet Protocol-based telecommunications services (VoIP, WiFi, WiMax, and LTE) will be able to connect to 9-1-1 via IP through routers and high-level security processes into an IP-based Next Generation 9-1-1 system.

Reference: <http://www.nena.org/>

11 Conclusions

The emergence of text messaging such as SMS, IM, and RTT is the natural solution for communications for persons with hearing or speech difficulties. The use of text messaging to 9-1-1 (“T9-1-1”) will be an improvement over methods such as TTY to 9-1-1 which are currently available to the DHHSI community.

Although SMS and IM has been in use for some time, it has been found that critical aspects of 9-1-1 access processing, such as automatic caller identification through network addressing, automatic routing to the designated PSAP and automatic location identification are not readily available on all text methods and their underlying technologies. Solutions that could be implemented over the near term will rely on existing methods for automatic routing to the designated PSAP and automatic location information presentation.

It is proposed that, subject to the Commission’s approval (ref: Decision, paragraph 38), the method that could initially provide text messaging to 9-1-1 (T9-1-1) to the DHHSI community in the shortest development interval will be the method that requires no new standards and the fewest modifications to existing network platforms or development of new network platforms.

Regardless of the technologies selected for T9-1-1, PSAPs will be affected in terms of PSAP terminal equipment upgrades and staff training.

DHHSI users of the T9-1-1 service will require instructions on how to register and unregister for the service, and how to use the T9-1-1 service.

Over the long term, as IP network technology matures and NG9-1-1 building blocks and platforms are established, the opportunity for multiple T9-1-1 solutions will become available on a large scale.

12 Key Recommendations

- a) Subject to Commission direction (ref: Decision, paragraph 38), a near-term solution for T9-1-1 service consisting of SMS messaging preceded by a silent wireless voice call (see section 9.2.7) with a “DHHSI” indicator for PSAPs, may be developed and trialed by the ESWG. This solution is confined to the DHHSI community and pre-registration for the T9-1-1 service is required.
- b) The technical trial is expected to span approximately 12 to 18 months. It will include the following activities:
 - Determination of the most efficient method for conveying a DHHSI indicator during a silent wireless 9-1-1 to a PSAP;
 - Determination of a SMS T9-1-1 registration process for DHHSI users and the associated network database architecture;
 - Development of a detailed technical specification for the service;
 - Development of a verification test plan;
 - Validation of the technical specifications in a controlled telecommunications environment;
 - Cost estimation to launch the service nationally, and proposing methods to fund same by all stake holders, e.g. TSPs and PSAPs;
 - Determination of a reasonable rollout plan for all parties involved;
 - Identification of specific PSAP staff training requirements;
 - Identification of specific DHHSI community education requirements, e.g. how to register, how to place a T9-1-1 call, how to switch from voice to SMS; and
 - Preparation of a technical trial concluding report to the Commission.

The commencement of these activities is subject to ESWG work plans.

- c) To simplify network architecture and to prevent traffic congestion, this proposed near-term service should be confined to the DHHSI community. In conjunction, DHHSI persons wishing to use this service must pre-register their wireless handsets prior to using the T9-1-1 service. The ESWG requires guidance from the DHHSI community and the Commission on the method of validating a SMS T9-1-1 service candidate during the registration process.
- d) If the CRTC wishes the service to become available to the general population, the T9-1-1 service will require redesign by the ESWG.

- e) The ESWG does not recommend a “sunset” date of this version of T9-1-1 at this point in time.
- f) A long-term solution for the DHHSI community and perhaps for the entire Canadian population using text methods such as IM or RTT will depend on the maturation level of IP networking and NG9-1-1. The ESWG should monitor these technologies and recommend them through the CISC process when the technologies meet E9-1-1 service criteria.

Appendix A – Glossary & Definitions

Term	Definition
0-ECRS	0- Emergency Call Routing Service (a tariffed service from ILECs)
3GPP	3 rd Generation Partnership Project. A 3 rd generation wireless technology group whose discussions are technically based upon the evolution of GSM core networks. http://www.3gpp.org/
3GPP2	3 rd Generation Partnership Project – 2. A 3 rd generation wireless technology group whose discussions are based upon evolution of CDMA radio access technology or ANSI-41 inter-mobile system signaling technology. http://www.3gpp2.org/
9-1-1 SP	9-1-1 Service Provider (usually an ILEC in Canada)
ALI	Automatic Location Identification system for the 9-1-1 service.
ANI	Automatic Number Identification. ANI serves a function similar to the “Caller ID” feature but utilizes different underlying network technology. In the context of this report, it is the wireless subscriber’s telephone number, normally transmitted to the PSAP as Call Back Number (CBN).
ANSI-41	American National Standards Institute 41. A mobile cellular telecommunications standard that supports inter-switch (i.e. Mobile Switching Centre; MSC) and database (i.e. Home Location Register; HLR and Visitor Location Register; VLR) messaging to support functionality such as handoff and roaming authentication. ANSI-41 supports AMPS (Analog Mobile Phone System), TDMA (Time Division Multiple Access), and CDMA (Code Division Multiple Access) technology. GSM (Global System for Mobile communications) access technology utilizes MAP (Mobile Application Part) for similar messaging.
ANSI J-STD-036	American National Standards Institute (ANSI) standard technical that describes the handling of wireless Phase II E9-1-1 calls. It was jointly developed by the Telecom Industry Association (TIA) and the Alliance for Telecommunications Industry Solutions (ATIS). https://www.atis.org/docstore/product.aspx?id=22688
ASP	Application Service Provider, e.g. Voting via a SMS shortcode.
B9-1-1	Basic 9-1-1 service. 9-1-1 service that receives emergency calls, but it does not have advanced 9-1-1 features such as automatic location display or call control features.

BPWG	CISC Billing Process Working Group
BGRP	Border Gateway Reservation Protocol
CBN	Call-Back Number. The calling party's telephone number that is provided to a PSAP. It may be valid or dialable (the PSAP can dial it and reach the caller) or invalid (the CBN has been truncated, is blank, is out of date, or contains digits not related to the caller's telephone number).
CISC	CRTC Interconnect Steering Committee
CLNPC	Canadian Local Number Portability Consortium
Country Code-1 (CC-1)	Related: North American Numbering Plan (NANP). The geographical area within North America that includes Canada, the US, and the Caribbean that uses Country Code 1. Telephone numbering within CC-1 follows the format NPA-NXX-XXXX, where NPA is the area code, N is a decimal digit ranging from 2 to 9, and X is a decimal digit ranging from 0 to 9. http://www.nanpa.com/reports/reports_npa.html
CDMA	Code Division Multiple Access. A wireless access technology that uses spread-spectrum technology and a special coding scheme over the same physical channel.
CLEC	Competitive Local Exchange Carrier
CNA	Canadian Numbering Administrator (www.Cnac.ca)
CO code	Central Office code (see NXX) – the 4 th to 6 th digits in a 10-digit NANP telephone number.
CPE	Customer Premises Equipment (usually refers to PSAP equipment)
CRTC	Canadian Radio-television and Telecommunications Commission
CS	Instant Messaging Connection Server
CSCN	CISC Canadian Steering Committee on telephone Numbering
CWTA	Canadian Wireless Telecommunications Association www.cwta.ca
Datagram	A message sent by packets.
Designated	The 9-1-1 call centre assigned in the 9-1-1 systems to the Emergency Service

PSAP	Zone incorporating the civic address where the wireline caller is physically located and/or the serving area for the wireless cell site/sector that initially captured the call
DHHSI	Deaf, Hard of Hearing, or Speech Impaired
E.161	An ITU-T recommendation which defines the assignment of the basic 26 latin letters (a to z) to the 12-key telephone keypad.
E.164	An ITU-T standard which defines the international public telecommunication numbering plan that is used within the public switched telephone network (PSTN). The E.164 telephone number has a maximum of 15 digits and is comprised of the following: Country Code (CC): 1 to 3 digits; National Destination Code (optional; in NANP this is called the area code or NPA and it has 3 digits such as 613); Subscriber Number (7 digits in the case of a NANP number).
E9-1-1	Enhanced 9-1-1. 9-1-1 service whereby the caller's location is automatically presented to the PSAP and the PSAP may have advanced call control features.
ESN	Electronic Serial Number (on CDMA handsets; similar to IMEI on GSM handsets) MINs are administered by the Telecommunications Industry Association. The ESN label on a handset is located under its battery. http://www.tiaonline.org/standards/resources/esn/documents/esn_guidelines_v2.0.pdf
ESRD	Emergency Services Routing Digits. ESRDs provide routing information for wireless Phase I and II E9-1-1 calls from WSPs to PSAPs and provide Phase I location information to the PSAP, i.e. cell/sector identification. They are in the format NPA-511-XXXX or NPA-211-XXXX. http://www.cnac.ca/esrd_codes/esrd_assignment_guidelines.htm
ESRK	Emergency Services Routing Key. A unique number assigned to a wireless 9-1-1 call.
ESWG	CISC Emergency Services Working Group
ESZ	Emergency Service Zone. The ESZ describes the PSAP area.
FSK	Frequency Shift Keying. A means of transmitting data over a voice channel.
GOC	Government of Canada
GSM	Global System for Mobile communications. A wireless access standard. iDEN and UMTS are related technologies. When GSM is mentioned in this report, the analysis also applies to iDEN and UMTS.

GMLC	Gateway Mobile Location Centre. The GSM/iDEN/UMTS system platform that receives, stores, and forwards position data within the wireless network.
HLR	Home Location Register. A central database located within each WSP system that contains a list of mobiles that is subscribed to that system.
HoH	Hard of Hearing
iDEN	Integrated Digital Enhanced Network. Wireless access technology that has been developed by Motorola that combines ingredients from trunked radio and cellular telephone systems. iDEN utilizes TDMA radio technology and its handsets have SIM cards.
i2	The National Emergency Number Association network architecture that addresses the intermediate solution for providing E9-1-1 service for users of VoIP telephony.
i3	The National Emergency Number Association network architecture that contains a true IP connection between the VoIP caller and the PSAP.
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force. The IETF is part of the Internet Society. The IETF develops standards for Internet architecture and features.
ILEC	Incumbent Local Exchange Carrier
IM	Instant Messaging
IMEI	International Mobile Equipment Identifier (serial number of a GSM handset; similar to ESN on CDMA handsets). They are administered by the GSM Association. The IMEI label is located under the battery of a handset. It may be electronically read by entering *#06# on the keyboard. http://www.gsmworld.com/documents/DG06_3v7-Draft.pdf
IMSI	International Mobile Station Identity. An identity number applicable to GSM, iDEN, and UMTS SIM cards. It is up to 15 digits long and is comprised of the Mobile Country Code (MCC), Mobile Network Code (MNC), and the Mobile Station Identification Number (MSIN).
IP	Internet Protocol
IPv4	Version 4 of the Internet Protocol
IPv6	Version 6 of the Internet Protocol

IP Relay	A service whereby an intermediate operator translates in real time text messages received via IP from a subscriber into voice for the destination recipient.
IS	Interim Specification
ISO	International Standards Organization
ISP	Internet Service Provider
IXC	Inter-Exchange Carrier (long distance service provider)
LAN	Local Area Network
Lapsed Subscription (short-term lapsed)	<p>The state of a handset where the subscription has lapsed and the handset will not pass registration. As a result, the handset cannot originate or receive calls (except for originating 9-1-1 calls). The WSP 24x7 support centre may have information corresponding with the subscriber.</p> <p>This definition also applies to prepaid phones with an account balance of \$0, where the handset's account has not entered the disconnected or unsubscribed state. The WSP 24x7 support centre may have information corresponding with the subscriber.</p>
Latitude	Coordinates based on a datum such as WGS84 representing the angular distance, in degrees, minutes, and seconds of a point north or south of the Equator. In decimal format, positive Latitude is: north of Equator; negative Latitude is south of Equator.
Layer	<p>A layer refers to the 7 layers within the OSI model. The seven layers include: physical, data link, network, transport, session, presentation, and application. IP is a protocol within OSI layer 3 (network).</p> <p>http://en.wikipedia.org/wiki/OSI_model</p>
LEC	Local Exchange Carrier
Longitude	Coordinates based on a datum such as WGS84 representing the angular distance, in degrees, minutes, and seconds of a point east or west of the Prime (Greenwich) Meridian. In decimal format, positive Longitude is east of Greenwich; negative Longitude is west of Greenwich.
LNP	Local Number Portability
MDN	Mobile Directory Number (the telephone number in an ANSI-41 based handset, such as CDMA). A MDN and MIN identify an ANSI-41 based handset.
MIN	Mobile Identification Number. The MIN identifies the WSP that an ANSI-41

	based handset (e.g. CDMA) is subscribed to. A ported handset's MIN will not match its MDN. Prior to the implementation of LNP / WNP, a handset's MIN matched its MDN. An active ANSI-41 based handset requires both a valid MIN and valid MDN.
MLP	Mobile Location Protocol (Specification: Open Mobile Alliance OMA-TS-MLP-V3_2-20051124-C) The protocol for obtaining the location of a handset, used between a 9-1-1 ALI platform and a WSP's location-determination platform.
MPC	Mobile Position Centre. The CDMA system platform that receives, stores, and forwards position data within the wireless network.
MRS	Message Relay Service (accessed by the abbreviated dialling code 7-1-1). Note that the MRS is not an emergency service.
MSC	Mobile Switching Centre. A centralized mobile telephone switching system that supports numerous cell sites and interfaces with trunks to the public switched telephone network (PSTN).
MSISDN	Mobile Station Integrated Services Digital Network. The telephone number associated with a GSM / iDEN / UMTS handset.
NAT	Network (IP) Address Translation
NG	Next Generation (IP-based telecommunications networks)
NANP	North American Numbering Plan. Also known as Country Code 1. The geographical area within North America that includes Canada, the US, and Caribbean countries that use Country Code 1. Telephone numbering within the NANP follows the 10-digit format NPA-XXX-XXXX, where NPA is the area code, N is a decimal digit ranging from 2 to 9, and X is a decimal digit ranging from 0 to 9. A listing of NANP area codes may be found at the following link: http://www.nanpa.com/reports/reports_npa.html
NENA	National Emergency Number Association www.nena.org
NG9-1-1	Next Generation 9-1-1: PSAP equipment that supports advanced telecommunication technologies such as VoIP or vehicle automatic collision detection.
NNI	Network to Network Interface
NPA	NPA. Numbering Plan Area, or Area code. Canadian NPAs may be viewed at: http://www.cnac.ca/npa_codes/npa_map.htm
NRC	National Relay Centre

NTWG	CISC Network Working Group
NXX	Central Office Code, the 4 th to 6 th digits in a 10-digit NANP telephone number.
OPEX	Operational Expense
OSI	Open System Interconnection
OSPF	Open Shortest Path First
P.01	Quality of Service - Probability of less than one (1) call out of one hundred (100) incoming calls will encounter a busy signal on the first dialing attempt during the busy hour of the average busy day
P.001	Quality of Service - Probability of less than one (1) call out of one thousand (1,000) incoming calls will encounter a busy signal on the first dialing attempt during the busy hour of the average busy day.
PC	Personal Computer
POTS	Plain Ordinary Telephone Service
PRL	Preferred Roaming List. A list that resides in a wireless handset that contains information used during the handset's system selection and acquisition / registration. The PRL enables a handset to roam onto foreign wireless carriers for the purpose of making and receiving calls. PRLs are downloaded to handsets during handset programming or during an Over The Air (OTA) handset update session.
PS	Instant Messaging Presence Server
PSAP	Public Safety Answering Point, a 9-1-1 call centre. Primary PSAP: A PSAP to which 9-1-1 calls are routed directly from the 9-1-1 Tandem and a Secondary PSAP: A PSAP to which 9-1-1 calls are transferred from a Primary PSAP.
QWERTY	A typical computer keyboard. The term "QWERTY" is derived from the second row of keys in the upper left-hand section of the keyboard. (ISO 9995)
Registered	The state of a handset where the handset has passed registration and the handset's information is stored in the VLR. During registration, the serving mobile switching centre (MSC), within the handset's home system (in the case of a home mobile) or a foreign system (in the case of a roamer mobile), consults the handset's Home Location Register (HLR; identified by the handset's IMSI or MIN number). The response to a positive registration request is stored in the MSC's VLR. In other words, successful

	registration enables the mobile's telephone number and service profile to be entered into the MSC's VLR.
RFC	Internet Engineering Task Force (IETF) Request For Comments (a draft standard)
RJ-11	Registered Jack – 11. A physical interface for a POTS residential phone. The jack has 6 contact positions and 4 conductors.
Roamer	<p>A handset that has come within the coverage area of a WSP other than its home WSP (the "ROAM" indicator becomes lit), and successfully passes registration. Handsets identify potential WSPs for roaming by its Preferred Roaming List (PRL), which is programmed into the handset. TIF 58 has identified three types of roamers:</p> <p><u>Domestic:</u> A handset from a Canadian WSP has roamed into and is supported by another Canadian WSP's coverage area.</p> <p><u>North American:</u> A handset from a wireless carrier within the NANP (Country Code 1; the handset has a 10- or 11-digit telephone number) has roamed onto and is serviced by a Canadian WSP.</p> <p><u>Overseas:</u> A handset from outside of North America (Country Code 1) has roamed onto and is supported by a Canadian WSP. The handset's telephone number may not be ten digits.</p>
RTT	Real-Time Text http://www.realtimetext.org/index.php?pagina=27
SI	Speech Impaired
SIM	Subscriber Identity Module. A card the size of a thumbnail that resides under the battery of GSM, iDEN, and UMTS-based handsets. The SIM card contains the identity of the home carrier (IMSI).
SMS	Wireless Short Message Service.
SOX	Sarbanes-Oxley (statutory requirements for publicly held companies)
SP	Service Provider
T9-1-1	Text to 9-1-1 service
Text Messaging	In the context of this report, Text Messaging is the act of sending a message by text using electronic technologies such as SMS, IM or RTT.

TIF	CISC Task Identification Form
TCP	Transmission Control Protocol, a protocol in layer 4 (the transport layer) of the OSI model.
TDD	Telephone Device for the Deaf. See TTY.
TERF	Text Emergency Routing Function (see 9.2.5.1)
TN	Telephone Number
TSP	Telecommunications Service Provider
TTY	Teletypewriter. A device that permits text messages to be exchanged between parties that have TTY devices. TTY signals are encoded in Frequency Shift Keying (FSK) over a telephone voice channel. The TTY signal protocol is described in ITU specification V.18
UK	United Kingdom
Uninitiated	The state of a handset where the CDMA handset has never been programmed with a MIN at a retail outlet or by other means. The handset has basic WSP information installed by the manufacturer and therefore will attempt a 9-1-1 call on the WSP network programmed in by the manufacturer. Instead of a valid telephone number, the 10-digit field may have all zeros or parts of the handset's electronic serial number (ESN). An uninitiated GSM handset does not have a valid, active SIM (SIMless).
Unsubscribed (long term lapsed)	A handset that has an identity with a specific WSP (via its MIN), but has no valid telephone number. The handset was active at one point in time but subscription has lapsed to the extent where the WSP has no record of the subscriber, or the telephone number has been ported out. In the case of long-term lapsed subscription, the telephone number is in aging, or is in a queue for assignment by a retail store, or has been assigned to a new and different subscriber.
Unregistered	The state of a handset that has not passed registration, e.g. the handset is suddenly powered up and a 9-1-1 call is placed. The subscriber may be valid or invalid. For calls other than 9-1-1, a handset must successfully pass registration before it can place or receive phone calls.
VLR	Visitor Location Register. A database located within each Mobile Switching Centre (MSC) that contains a list of validated and active mobiles served by that switching system.
VoIP	Voice over Internet Protocol
VRRP	Virtual Router Redundancy Protocol

WiFi	A wireless LAN standard based on IEEE 802.11
WiMAX	A wireless data transmission standard based on IEEE 802.16.
WSP	Wireless Service Provider

SMS T9-1-1 Call - Analysis of DHHSI Flag Options

Section	Indicator Method	Description	WSP Remarks	9-1-1 SP Remarks	LEC & IXC Remarks	PSAP Remarks	DHHSI Impact	Recommendation
9.2.7.3.1	Manual lookup	PSAP manually checks CBN via national database	Database update methods require development	No impact on 9-1-1 SP infrastructure	n/a	Manual lookup processes are not recommended	Delay in SMS T9-1-1 service	Not recommended.
9.2.7.3.2	Reverse ALI	PSAP manually checks CBN via reverse ALI	Database update methods require development	ALI network development for accepting DHHSI TNs and reverse ALI	n/a	Manual lookup processes are not recommended	Delay in SMS T9-1-1 service	Not recommended.
9.2.7.3.3	DHHSI Wireless handset TNs loaded into ALI databases	Subscriber registers TN on web site (central database feeds ALIs)	Customer records impact	ALI development required to expand dip during 9-1-1 call	n/a	A flag is essential. Potential CAD impact.	How are DHHSI persons authenticated during registration?	Potential solution. Investigate further.
9.2.7.3.4	Abbreviated dialling code	9xx or * code or # code	High MSC impact	ALI voice and data infrastructure development required	n/a	9-1-1 voice network impact		Not recommended
9.2.7.3.5	Unique area code (e.g. 5XX SAC or unique NPA)	Unique area code identifies DHHSI user.	Unique area code management in back office systems.	No impact unless flag required for PSAP.	Significant impact (rating, LNP, etc).		Existing users must change TN. May be restricted to outgoing calls only.	Might be feasible. Investigate further.

Section	Indicator Method	Description	WSP Remarks	9-1-1 SP Remarks	LEC & IXC Remarks	PSAP Remarks	DHHSI Impact	Recommendation
9.2.7.3.6	Unique central office code	Unique CO code identifies DHHSI user.	Unique CO code management in back office systems.	No impact unless flag required for PSAP.	Significant impact (rating, LNP, etc).	Monitoring of multiple NPA-NXX combinations.	Existing users must change TN	Investigate possible NPA exhaust impact.
9.2.7.3.7	WSI Indicator	Provision a unique flag with the subscriber's telephone number. Transmit via MLP.	High impact to most WSP platforms	ALI development required				Not recommended.

SMS T9-1-1 Call - Analysis of DHHSI Flag Options (continued)