IMPLEMENTATION OF LOCAL COMPETITION

CRTC INTERCONNECTION STEERING COMMITTEE

REPORT to the CRTC

by

INDUSTRY WORKING GROUP

<u>Emergency Services (9-1-1) Working Group</u>

<u>TIF 41 Consensus Report</u>

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TITLE: Identification of Issues for Provision of 9-1-1/E9-1-1 Service
      to Fixed/Non-Native VoIP Customers

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DATE: October 27, 2005

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IMPLEMENTATION OF LOCAL COMPETITION
Report to the CRTC

Task ID(s):   ESTF041

Task Name(s):   9-1-1/E9-1-1 Service delivery when local VoIP Service is offered on a fixed/non-native basis

Task Description: The Commission requests CISC to submit to the Commission, within six months from the date of Telecom Decision CRTC 2005-21, a report identifying the technical and operational issues that impede 9-1-1/E9-1-1 service delivery when local VoIP service is offered on a fixed/non-native basis. The report should identify all viable solutions and recommend the preferred solution, with supporting rational, and a proposed timeframe for implementation.

Introduction: This consensus report addresses the directive given to the ESWG in Telecom Decision CRTC 2005-21 at paragraph 73.

Conclusion: As requested, the ESWG has identified issues, solutions and suggested timeframes related to the introduction of E9-1-1 service for Fixed/Non-Native local VoIP service.

1   Scope

1.   In Telecom Decision 2005-21, the Commission requested that CISC "submit to the Commission, within six months from the date of this Decision, a report identifying the technical and operational issues that impede 9-1-1/E9-1-1 service delivery when local VoIP service is offered on a fixed/non-native basis", and that the "report should identify all viable solutions and recommend the preferred solution(s), with supporting rationale, and a proposed timeframe for implementation".

2.   The purpose of this document is to identify issues, solutions and suggested timeframes related to the introduction of E9-1-1 service for Fixed/Non-Native local VoIP service. The scope of the current document is limited to the Fixed/Non-Native case, and excludes issues that may be specific to Fixed/Native or Nomadic local VoIP service. It should be noted that although all CISC ESWG participants including TELUS have been provided opportunities to review and contribute to the development of this report, TELUS' participation has been limited somewhat due to resource reassignment resulting from an ongoing labour disruption.

3.   Many of the issues and solutions identified in this document may also relate to, or could have an impact on, the provision of E9-1-1 service where local VoIP service is offered on a nomadic basis. In the coming months, the CISC ESWG will be actively considering the 12 month report that was also requested by the Commission on issues and solutions relating to nomadic service. Given the significant expenditures and other resources required to address the issues outlined in this report that currently prevent local VoIP service providers from providing E9-1-1 service to Fixed/Non-Native and given that VoIP Fixed/Non-Native subscribers in Canada currently receive basic 9-1-1 service pursuant to the interim solution mandated by the Commission in Telecom Decision CRTC 2005-21, the CISC ESWG recommends that the Commission not direct

implementation of any of the solutions discussed in this report until the Commission has received and considered the ESWG's 12 month report.

2   Introduction

4.   This document summarizes the issues and solutions identified to date by the CISC Emergency Services (9-1-1) Working Group related to the provision of 9-1-1/E9-1-1 service to local VoIP subscribers with fixed VoIP service who are assigned telephone numbers that are not native to their local exchange.

5.   In using the term fixed to describe local VoIP services, whether it is provided with a native or a non-native telephone number, the Commission is referring to services without nomadic capability. By way of examples, a 'non-native' scenario may include a VoIP subscriber located in Gatineau who is assigned a telephone number with an area code from another province (e.g. 604), or it may include a subscriber who is assigned the regular area code for their location, but receives a 7-digit number that would normally only be available in a different local exchange (e.g. a Mississauga subscriber located in Port Credit who is assigned a 7-digit number native to the Clarkson local exchange).

6.   In the traditional PSTN, a similar capability has generally been referred to as geographic number portability, i.e. the ability to keep one's originally assigned 10-digit telephone number even when moving his/her telephone service to a new location, including those locations where a different area code has traditionally been in use. Implementation of such portability in the traditional PSTN represents an enormous challenge, as the call routing translations used in switches throughout the network have historically been based on a firm correlation between local exchanges and fixed geographic boundaries. In the VoIP world however, a network termination is addressable using an assigned IP address and voice packets can be successfully routed through IP portions of the network without depending on the associated 10-digit telephone number assigned to the network termination. Thus the ability for VoIP service providers to assign and use 'non-native' telephone numbers is trivial in terms of call routing.

7.   Outside of call routing, several other issues have historically been raised with respect to geographic number assignment, including Long Distance billing and 9-1-1 related concerns. The ANI (Automatic Number Identification) associated with a given PSTN call has traditionally been considered somewhat 'sacred' in terms of explicitly identifying the calling party. In particular, the inclusion and accuracy of ANI on a call-by-call basis is necessary to facilitate correct operation of existing E9-1-1 systems. In order to provide E9-1-1 support for Fixed/Non-Native local VoIP service, a variety of equipment, systems, processes and policies may need to be modified. The CISC Emergency Services (9-1-1) Working Group has committed to moving forward with identification of all related issues and potential solutions. At this time, one desirable outcome from these activities would be a consensus document providing viable, industry supported solutions to all identified issues.

3   Issues

3.1   Data

3.1.1 Class of Service

8.   Each telephone number populated in the ALI database is assigned a Class of Service code that indicates the type of telephone service provisioned for the network termination associated with the telephone number. When a PSAP agent answers an incoming 9-1-1 call, Enhanced 9-1-1 (E9-1-1) enables the ability for certain information about the 9-1-1 caller (e.g. name, address, Class of Service, etc.) to be automatically displayed to the call taker. Examples of existing Class of Service types may include: residential line, Centrex line, pay-phone, etc. It should be noted that the number of different class of service codes in use, as well as their definitions, currently varies from ILEC to ILEC.

9.   The CISC Emergency Services (9-1-1) Working Group is considering the need to introduce new Class of Service codes to address those local subscribers that are provisioned with VoIP service. In particular, these VoIP-specific Class of Service codes might indicate if a subscriber was provisioned with fixed or

nomadic VoIP service, or whether the VoIP subscriber was a residential or enterprise style subscriber (e.g. single line versus multiple lines behind a VoIP PBX). The determination and justification of VoIP-specific Class of Service codes for various scenarios unrelated to the Fixed/Non-Native case will be left as a future exercise for the CISC ESWG.

10.   As the context of this report is related to issues specific to providing E9-1-1 service for Fixed/Non-Native local VoIP subscribers, the Class of Service question can be reduced to two considerations:

1. The need for a new Class of Service code to distinguish between traditional (fixed) local telephone service and fixed local VoIP service

2. The need for a new Class of Service code to distinguish between fixed local VoIP service provisioned with native versus non-native telephone numbers

11.   For the first consideration, the CRTC in Telecom Decision CRTC 2005-21 directed: "Canadian carriers, offering fixed (i.e., non-nomadic) local VoIP service, where the end-user is assigned an NPA-NXX native to any of the local exchanges within the region covered by the customer's serving Public Safety Answering Point (PSAP), to provide 9-1-1/E9-1-1 service, where it is available from the incumbent local exchange carrier (ILEC)…". At this time then, those local VoIP Service Providers offering Fixed/Native service are obligated to provide E9-1-1 service and new VoIP specific Class of Service codes have been introduced in limited areas. Some have suggested that this may be an appropriate long term scenario, stating that if traditional local telephone service and fixed local VoIP service behave in exactly the same way from the perspective of the PSAP, and all E9-1-1 related features (including Call Party Hold, Ringback, call tracing, etc.) are supported, it may obviate the need to introduce a new Class of Service code. Others have suggested that PSAP agents would always benefit from the ability to distinguish between traditional telephone subscribers versus VoIP subscribers, perhaps due to perceived

differences such as voice quality or exact functionality of supported capabilities. By way of example, certain VoIP configurations may eliminate background noise during silent pauses in a conversation, which might otherwise provide 9-1-1 call-takers with important contextual information.

12. Where differences or limitations exist pertaining to 9-1-1/E9-1-1 service for fixed local VoIP subscribers, one or more new Class of Service codes may be needed in order for 9-1-1 call-takers to identify and categorize VoIP subscribers on a call-by-call basis. It seems logical to conclude that the question of the need for a new class of service code(s) for fixed local VoIP service is an important consideration irrespective of whether the telephone number assigned to the VoIP subscriber is native or non-native.

13. The second consideration – whether the fixed local VoIP service is provisioned with a native versus non-native telephone number – appears to provide minimal justification for introducing a new Class of Service designation. Historically the Class of Service codes have been devised to describe the physical configuration of the service provisioned (e.g. residential line, business line, coin telephone, etc.) as opposed to the numbering plan associated with the service. In a Fixed/Non-Native local VoIP E9-1-1 scenario, a PSAP agent should always receive both the Class of Service code as well as the telephone number assigned to the caller. Whether the number displayed had for example an out of province area code, this alone should not affect the E9-1-1 features and characteristics available to the agent for that given call. This scenario is not unlike the wireless situation that exists today, where PSAP agents routinely receive calls from callers (e.g. travelers) that have out-of-region telephone numbers.

14. Overall then, it would appear that the ultimate decision as to whether to introduce new Class of Service codes for fixed local VoIP subscribers will be based on whether fixed local VoIP service has certain characteristics that differ

from traditional telephone service, and not on whether the assigned telephone number is native or non-native.

15.   Introducing new Class of Service codes would require the existing E9-1-1 service providers (primarily ILECs) to devise new Class of Service definitions and associated codes, and then to modify existing ALI database and data input systems to accommodate these new codes. It should be noted that some E9-1-1 service providers may use equipment that enforces an upper bound on the maximum number of Class of Service codes supported – any plan to introduce new codes might necessitate modifications to existing systems to increase this limit. Introducing new Class of Service codes would also necessitate the update of existing documentation and publications, as well as an information campaign to inform any/all users of the changes –most notably the PSAPs.

16.   To date, only one of the Canadian 9-1-1 service providers has implemented VoIP-specific Class of Service codes. In February of 2005, Bell Canada introduced two new Class of Service codes for VoIP services provided in Ontario and Québec: CIP (Consumer IP) and MIP (Managed IP).

17.   The introduction of new Class of Service codes is not unprecedented – having occurred previously in support of wireless service introduction. The effort involved to introduce new Class of Service codes could be considered moderate, and the time frame required would be estimated as less than 6 months.

18.   MTS Allstream has confirmed that their ALI database vendor is no longer making changes to the database version that MTS Allstream currently uses. Introducing new Class of Service Codes would require MTS Allstream to upgrade their ALI database, and then make the corresponding Class of Service modifications to the new database. The time frame required to accommodate this effort is estimated as less than 12 months.

3.1.2 ALI – Data Input Validation Rules

19.   Existing ALI databases are already structured to accommodate the input and storage of ten digit telephone numbers (as well as name, address, etc.). ALI database queries also produce telephone number information in a ten digit format, and PSAP E9-1-1 equipment (may include CRTs, printers, etc.) currently displays all telephone number information in a ten digit format. No changes to the ALI database format or PSAP equipment should result from the introduction of non-native number support for fixed local VoIP service, assuming that the numbers conform to the North American Numbering Plan (NANP).

20.   Although existing ALI databases support ten digit telephone numbers, certain ALI databases – and the associated systems used to input data – may validate data input and restrict telephone numbers to those containing specific area codes (NPA) or other criteria. As an example, it might be the case that the ALI database in Manitoba would restrict a data input clerk from entering anything other than 204 for the area code. To support the assignment of non-native telephone numbers for fixed local VoIP service, these restrictions – where they exist – would need to be eased in order to accommodate out of region numbers.

21.   An additional point of interest for potential future consideration may be the inclusion of international format telephone numbers or other possible address designators (e.g. URL, email address or other) of varying length that do not follow the ten-digit NANP format. This concept may have dramatic consequences in terms of network, equipment, routing, training or operations impacts for E9-1-1 service providers and PSAPs alike however.

22.   Varying the ALI database data input validation rules to accommodate non-native 10-digit NANP numbers would not appear to affect any database field lengths within the existing ALI databases, the database structures, the existing protocols or interfaces used to transmit telephone number information to the PSAPs, nor the PSAP equipment itself. The changes required would seem primarily limited to the modification of logic rules that may be used by the system

which supports ALI database population, as well as the possibility that the introduction of many new NPAs would drive an ALI database resizing exercise that may necessitate hardware upgrades (e.g. memory or hard disk augmentation).

23.   Bell has confirmed that their ALI system already supports non-native NPAs. TELUS has confirmed that data selection criteria currently exist for inputting data to their ALI database. MTS Allstream has confirmed that their current ALI database supports one NPA only – any attempt to input a non-native NPA will result in an error condition. MTS Allstream has also confirmed that upgrading their ALI database to the latest version would alleviate this restriction. SaskTel has confirmed that its ALI database supports a maximum of four NPAs.

24.   The effort involved to modify ALI data input validation rules should be considered minimal – except in the case of MTS Allstream and SaskTel – and the time frame required would be estimated as less than 6 months.

3.1.3 DBMS – Data Input Validation Rules

25.   Certain E9-1-1 service providers – namely Bell, Aliant, MTS Allstream and SaskTel – have indicated that along with the ALI database, they also operate a Database Management System (DBMS) which, along with providing a variety of functions, acts as a 'front-end' to the ALI database. In a virtually identical scenario to the data input validation rules described for ALI databases in Section 3.1.2, certain DBMS systems may also validate data input and restrict telephone numbers to those containing specific area codes (NPA) or other criteria. To support the assignment of non-native telephone numbers for fixed local VoIP service, these restrictions – where they exist – would need to be eased in order to accommodate out of region numbers. SaskTel has confirmed that its DBMS can currently only accommodate the 306 NPA.

26.   Changes required would seem to be limited primarily to modification of logic rules that may be used by the DBMS system – where it exists – to inspect

and qualify DBMS data entry. However more complex modifications to ESN assignment and 9-1-1- SRDB management are expected.

27.   Bell has confirmed that their DBMS system already supports non-native NPAs. MTS Allstream has confirmed that their DBMS does not support non-native NPAs.

28.   The effort involved to modify any DBMS data input validation rules would be considered minimal – except in the case of MTS Allstream and SaskTel - and the time frame required would be estimated as less than 6 months.

3.1.4 NPA Validation

29.   Based on the need for certain E9-1-1 service providers to loosen NPA data input rules to accommodate non-native telephone numbers, a question was raised regarding the overall need to have the data input system automatically verify the validity of area code information entered. This type of automatic verification could prevent a data entry clerk (where manual data input was used) from inadvertently entering an invalid NPA at the time of ALI database population, but would still support entry of an incorrect (but otherwise valid) NPA. One possible means of confirming the validity of area code information would be to compare the data entered against a list of currently valid area codes (e.g. the LERG which is published monthly). This scheme has the potential to significantly increase the cost and complexity of accommodating non-native NPAs however. A plan to limit non-native numbers to only those with Canadian NPAs would simplify this scheme, as there are currently only 24 Canadian NPAs in service.

30.   Due to the existing requirement for precise data entry of the 7-digit portion of native 10-digit numbers, it appears appropriate that the level of care with respect to data entry of non-native 10-digit numbers could legitimately rest solely on the care exercised by the data entry clerk, i.e. without the need for additional automated data entry rules related specifically to NPA validity. Also, this may be a moot issue for the case of E9-1-1 service providers that have electronically

integrated their provisioning systems with other back-office systems to alleviate the need for manual input of ALI information.

31.   Bell has confirmed that this is not an issue for their 9-1-1/E9-1-1 service – their systems ensure that only acceptable/allowed NPAs can be input.

32.   Although raised as a discussion point in the CISC ESWG, this particular topic will not be considered as an impediment to the introduction of E9-1-1 for Fixed/Non-Native local VoIP service. Once any ALI and DBMS data input validation rules (where they exist) have been altered to accept non-native NPAs, the question as to the benefit of implementing additional logic to qualify the validity of NPAs prior to input will be left to the discretion of the 9-1-1 service provider.

3.1.5 Trouble Reporting

33.   In the case of problems or issues related to the provisioning, operation and ongoing support of E9-1-1 for local VoIP service, trouble reporting and resolution processes must be implemented between any associated companies and service providers. In particular Local Service Providers (LSPs) – be they traditional or VoIP providers – must provide contact information to the PSAPs specifying the LSP organisation that will be capable of accommodating name, address or other corrections and confirmations.

34.   The particular types of incidents that invoke trouble reporting procedures may be wide ranging, but would typically include any problems that negatively impact correct operation of 9-1-1/E9-1-1 systems. One important example is related to incorrect call routing, where a 9-1-1 caller is connected to the wrong PSAP. Other examples might include incorrect ALI information, incoming 9-1-1 calls received with no ANI, or various equipment failures or malfunctions.

35.   The requirement for 7x24 troubleshooting, call tracing, access to current and accurate subscriber records and data correction procedures, is a public safety responsibility irrespective of the type of technology used to provide local

voice and 9-1-1/E9-1-1 services. Optimally, there would be no need to 'reinvent the wheel' – wherever possible existing trouble reporting processes might be utilized as a practical foundation for future requirements. Non-native numbers may create more complex trouble reporting, and event management.

36.   The effort involved modifying any trouble reporting rules, systems or processes to accommodate Fixed/Non-Native local VoIP services would be considered minimal, and the time frame required would be estimated as less than 6 months.

3.1.6 LSP ID

37.   For each E9-1-1 call placed to a PSAP, the PSAP agent typically receives LSP ID and LSP Name information via the ALI record which specifies the Local Service Provider of record associated with the caller. This LSP must provide contact information to the PSAPs specifying the LSP organisation that will be capable of accommodating name, address or other corrections and confirmations, as well as supporting troubleshooting or maintenance activities.

38.   In the current environment, a typical configuration utilized by local VoIP Service Providers is to lease 'line-side' circuits as a means of interconnecting with the PSTN. This scenario poses an important question as to the identity of the LSP of record – either the local VoIP Service Provider providing the local VoIP service, or the underlying LEC (ILEC or CLEC) providing the line-side circuits to the local VoIP service provider. In the first case, PSAPs would be able to directly contact the local VoIP service provider in cases where information needed to be clarified or corrected. The second case would represent a two-stage process, whereby the PSAP would contact the underlying LEC, who would then contact the local VoIP service provider on behalf of the PSAP. Although the first case appears more desirable, it would necessitate the assignment of LSPIDs to each of the (potentially 1000s of) local VoIP service providers that entered the market. In the second case there may also be some effort by the underlying LEC to ensure the VoIP service provider's information is available to be relayed to the

PSAP. Ensuring that the information is available may require some system modifications on the part of the LEC.

39.   Regardless of which scenario is selected, assignment of LSPIDs ultimately provides little value if the corresponding LSP does not provide timely access to accurate subscriber record data and/or repair personnel on a 7x24 expedited basis.

40.   Bell and former NBTel have implemented a NENA recommendation whereby two LSPIDs are assigned to each ALI record – one to address voice network related issues, and one for data correction.

41.   This issue, although important, is not specifically related to the introduction of Fixed/Non-Native local VoIP service.

3.2   Routing

3.2.1 Valid Numbers

42.   Current plans to support E9-1-1 for Fixed/Non-Native VoIP service limit assigned telephone numbers to those that follow existing NPA-NXX rules and standard dialing plans, as well as specified number pools that are temporarily assigned to calls strictly for the purposes of routing to the correct PSAP (such as ESQK or pANI numbers). Any plans to support non-NANP numbering or other addressing schemes (e.g. URL, email address or other) are beyond the scope of this document.

3.2.2 SRDB Limitations

43.   Depending on the equipment vendor(s) used to implement the 9-1-1 Selective Router (a.k.a. 9-1-1 Tandem) and Selective Routing Database (SRDB), there is a possibility that software limitations may exist regarding the maximum number of NPAs that can be populated. In Canada all SRBD functionality is resident within the selective router in the 9-1-1 tandem.

44.   The effort involved to modify SRDB limitations pertaining to a specific vendor's platform would be considered significant only because this would require software development on the part of the equipment vendor with the possibility of a high price tag, and extended time frame to develop. SaskTel confirms that its SRDB can currently only accommodate the 306 NPA. Although not confirmed by testing, SaskTel expects significant issues with introducing non-306 NPAs which may require switch vendor dependant changes to the E9-1-1 software.

45.   With the exception of MTS Allstream, all current 9-1-1 service providers use Nortel hardware. As a result software and hardware modifications may be required. If modifications are required, the time frame required to remove limitations related to the issue of SRDB limitations would be estimated as less than 12 months.

3.2.3 Switch Table NPA Limitations

46.   Depending on the equipment vendor used to implement network switching equipment, there is a possibility that software limitations may exist regarding the maximum number of NPAs that can be populated in call processing/call routing tables.

47.   An important consideration in terms of VoIP service would be the range of acceptable/allowed NPAs available for use with Fixed/Non-Native service. As there are currently 24 NPAs in service in Canada, a plan to restrict non-native NPAs to Canadian NPAs only may alleviate issues related to switch table limitations. A plan to include all active NPAs in North America as specified by NANPA – currently 329 and rising – would potentially exceed the maximum number of NPAs currently allowed in switch tables.

48.   Bell has confirmed that their switch vendor limits the number of usable NPAs via table "SNPANAME" which currently imposes a maximum limit of 127 NPAs.

49.   The effort involved to modify NPA limitations pertaining to a specific vendor's switching platform has the potential to be quite significant. Although the maximum number of NPAs might only be directly limited by a single table, several other tables or software processes may have dependencies on this table, meaning that the effort required modifying, testing and implementing changes may be considerable.

50.   Much like the situation regarding SRDB limitations, the effort involved to modify switch table limitations pertaining to a specific vendor's platform would be considered significant only because this would require software development on the part of the equipment vendor with the possibility of a high price tag, and extended time frame to develop.

51.   If required, the time frame required to modify limitations related to switch table NPA limitations would be estimated as less than 18 months.

3.2.4 Default Routing

52.   Fixed/Non-Native VoIP service breaks the geographic association keyed on the telephone number of the caller that is used by traditional wireline services and by wireless services for selective and default routing. For legacy wireline services the association of a location with a telephone number is pre-assigned, for wireless services the association of a location is determined on the serving tower location along with the ESRD for purposes of routing. Fixed/Non-native VoIP service breaks this geographic association. Hence, the 9-1-1 selective and default routing, currently used as the caller's location, may not be pre-determined (i.e. it is possible to have a 403 number assigned to a fixed/non-native user in a 416 area code location) nor can the location be determined through service use. The result is that Fixed/Non-native VoIP calls will likely fail selective routing and may inappropriately default route based on the incoming trunk group default.

53.   The National Emergency Number Association (NENA) describes techniques that can be used for default routing of 9-1-1 calls when the platform is unable to selectively route an incoming 9-1-1 call via an Enhanced 9-1-1

Selective Routing Database (E9-1-1 SRDB) lookup, using a predetermined Emergency Service Number (ESN) that details the set of 9-1-1, police, fire and ambulance agencies responsible for the caller's location. To allow E9-1-1 selective routing, an ESN is assigned to each telephone number and is pre-populated in the designated E9-1-1 SRDB. For default routing purposes, an ESN is assigned

- and pre-populated for each NPA-NXX code existing in the 9-1-1 serving area (typically to facilitate E9-1-1 SRDB upload and processing, and for database capacity storage purposes) and

- to each incoming 9-1-1 trunk group interconnecting directly at the E9-1-1 Selective Router (typically to manage routing due to a network error or other unexpected condition).

54.   Examples of situations that might cause such an event would be a data entry error or the specific ANI is missing in the E9-1-1 SRDB, perhaps due to processing delay to input the customer's data, or a call that arrives at the E9-1-1 Selective Router with an invalid or missing ANI, perhaps due to a facilities glitch or other system malfunction.

55.   9-1-1 service providers in Canada currently support both selective and default routing assignment and management schemes similar to the ones depicted by NENA and that meet their 9-1-1 equipment vendor's routing specifications. An ESN is assigned to each telephone number, either directly by the Local Service Provider (LSP) when creating the 9-1-1 transaction record or during the 9-1-1 DBMS' SRDB assignment process. Each NPA-NXX is assigned a default ESN mainly to allow for 9-1-1 DBMS to E9-1-1 SRDB upload, 9-1-1 DBMS and E9-1-1 SRDB data processing and E9-1-1 SRDB data storage management. When a carrier initially establishes facilities and trunks to an E9-1-1 Selective Router, a three digit ESN (Emergency Service Number) code that best represents the Primary Public Safety Answering Point's (PSAP) Emergency Service Zone (ESZ) is assigned to each dedicated 9-1-1 incoming trunk group. A

trunk group's default routing is accomplished as a consequence of establishing multiple trunk groups to the E9-1-1 Selective Router.

56.   In the case of Fixed/Non-Native VoIP service, it would be contingent on the VoIP service provider and the 9-1-1 service provider to ensure that each trunk group connected to an E9-1-1 Selective Router be carefully selected so as to represent a PSAP serving area that deals with the geographic area of the caller. Default routing rules established by the 9-1-1 service provider and approved by the municipality/PSAP must then ensure that Fixed/Non-native local VoIP calls are routed to the designated PSAP even for cases when the caller's specific ANI is unavailable or when the associated NPA-NXX's default ESN cannot be retrieved.

57.   During a 9-1-1 call, the E9-1-1 SRDB looks first for the caller's specific ANI, if not present then it looks for the NPA-NXX or NPA associated with the caller's ANI, if neither are present in the E9-1-1 SRDB table, the E9-1-1 Selective Router then uses the 9-1-1 incoming trunk group's default ESN to route the call to the designated Primary PSAP and for further call transfer to dispatch agencies. In today's E9-1-1 network architecture and technology, it is expected that all telephone number and associated NPA-NXX entries, within acceptable/allowed NPA codes, are pre-stored in the E9-1-1 SRDB database(s) prior to receiving a 9-1-1 call from these numbers.

58.   The issue of assigning a trunk group's default ESN is not technically specific to the introduction of Fixed/Non-Native local VoIP service. ESZ/ESN-associated trunk groups will be required for E9-1-1 Selective Router trunks established by VoIP service providers or their transport agent(s) regardless of whether the service provided is Fixed/Native or Fixed/Non-Native. In the case where the VoIP service provider connects to the E9-1-1 Selective Router via an underlying LEC, the onus will be on the VoIP service provider and the LEC to ensure that 9-1-1 calls placed from a certain region will be routed to the

appropriate 9-1-1 trunk group in order to facilitate correct operation of default routing.

59.   The issue of assigning a default ESN to an "out-of-region/province" NPA-NXX is technically specific to the introduction of Fixed/Non-Native local VoIP service. Moreover, the assignment of telephone numbers from existing NPA-NXX (used for traditional services) to Fixed/Non-Native local VoIP service will force the 9-1-1 Service Providers to modify the 9-1-1 DBMS' and E9-1-1 SRDB's NPA-NXX default assignment, management and operations and potentially part of their E9-1-1 voice network.

60.   Implementation of automatic, real-time Emergency Service Query Key (ESQK) and associated ESN assignment on a call-by-call basis (using a remote VoIP Positioning Center (VPC)), steering ALI database interface and protocol or usage of an off-board E9-1-1 SRDB look-up when a 9-1-1 call reaches the E9-1-1 Selective Router (as well as the implementation of a trunk group's ESN for default routing in the case where telephone number and NPA-NXX ESN information was unavailable), or other such solutions, have not yet been considered by the CISC ESWG. Indeed, this represents only one of many possible solutions to issues raised by fixed/non-native VoIP services for the default routing of 9-1-1 calls.

61.   While implementation of such schemes could alleviate the need for local VoIP service providers (as well as CLECs) to implement multiple trunk groups to the E9-1-1 Selective Router, the impact on the existing E9-1-1 network infrastructure, systems and operations will be substantial. On the other hand implementing support for non-native number assignment, especially for "in-region" numbers could have significant implications in terms of E9-1-1 SRDB data population and management. It was confirmed that changing existing techniques used for default routing may represent the single largest challenge to supporting E9-1-1 for fixed/non-native VoIP service, especially for managing

traditional services sharing existing NPA-NXX with VoIP local service, which would require further study to estimate and to quantify.

62.   While the effort involved to implement default routing for "out of province" Fixed/Non-native local VoIP service would be considered minimal, "in-province" Fixed/Non-native local VoIP service would be considered moderate to large, as it will have an impact on existing E9-1-1 network architecture, operations and data entry management. In the absence of a recommended solution a proposed timeframe for implementation cannot be provided. The issues identified in the above paragraphs will be addressed in the 12 month report or sooner.

3.3   Interconnection

3.3.1 7-Digit vs. 10-Digit Routing

63.   A significant challenge regarding the support of Fixed/Non-Native VoIP service by certain 9-1-1 service providers relates to the configuration of existing facilities used to connect voice switches to their 9-1-1 Selective Routers. Across Canada, no single standard currently exists related to the type of interconnection facilities used for 9-1-1 calls, nor the associated call routing protocols. In some areas, full 10-digit call routing is supported (NPA + 7-digit telephone number), whereas in other areas calls are still routed to the Selective Router using only 7-digits. In certain instances, Selective Routers may be configured to accommodate both 7-digit and 10-digit call routing.

64.   When a call arrives at a Selective Router, the designated PSAP is determined, and the call is routed and connected to that PSAP. When the call arrives at the PSAP, ALI/ANI information is automatically provided to the PSAP agent for incoming E9-1-1 calls. The ANI information usually provided to the PSAP agent *does* include the NPA, however this information is extracted from the ALI database and is not dependent on whether 7 or 10-digit 9-1-1 call routing is used. One obvious drawback to a 7-digit 9-1-1 call routing scheme relates to

support of non-native telephone number assignment for fixed local VoIP services. In this case, the correct ALI record associated with the incoming 9-1-1 call cannot be obtained without knowledge of the NPA associated with the caller's telephone number.

65.   A desirable consequence of the architecture used to implement E9-1-1 services in Canada – where the ALI database query is facilitated mainly by the 9-1-1 Selective Router as opposed to by the PSAP – is that existing facilities used to interconnect the 9-1-1 Selective Router with the PSAPs do not need to be upgraded to facilitate the transition from 7-digit routing to 10-digit routing on the 9-1-1 Selective Router. This represents a significant savings in both cost and effort as compared to a scenario that necessitates upgrades to all PSAP facilities and equipment.

66.   The implementation of 10-digit routing support on the 9-1-1 Selective Router may require a minor corresponding modification of the ALI database query protocol to accommodate inclusion of the NPA on a per-call basis. It should also be noted however that no changes should be required to the existing protocols and facilities used to transmit the ALI data from the 9-1-1 Selective Router to the PSAPs – they already accommodate the transmission of 10-digit ALI information.

67.   The activities necessary to implement 10-digit 9-1-1 call routing where 7-digit routing exists today depend in part on the particular equipment manufacturer used by the 9-1-1 service provider. Support for 10-digit routing on existing MF facilities might be achieved using Enhanced MF Signaling capabilities as described in Telcordia's Generic Requirement GR-2953-CORE (which actually supports the delivery of two separate 10-digit numbers). Implementing this capability would typically require changes to software only, including the potential requirement to purchase additional software feature(s) and corresponding changes to trunk and call-routing tables.

68.   It should be noted that although Enhanced MF signaling may be configured to support wireless Phase I E9-1-1 implementations (for example by out-pulsing a second 10-digit pseudo ANI (pANI) associated with the cell site/sector in use by the wireless caller), 9-1-1 service providers planning to upgrade existing MF facilities would be well advised to take into consideration potential future requirements for wireless, VoIP or other technologies that may also drive subsequent facility or network upgrades or reconfigurations. As one example, any potential future plans to support wireless Phase II E9-1-1 using a Call path Associated Signaling (CAS) scheme may cost-justify upgrading directly to ISUP trunking (which of course supports 10-digit routing) and bypassing the implementation of Enhanced MF signaling altogether. Another important consideration is the fact that Enhanced MF facilities can result in call set-up times of a few seconds per call leg – due to the requirement to outpulse 20 digits – which is particularly undesirable in a 9-1-1 scenario.

69.   It should be noted that the issues surrounding 7-digit versus 10-digit routing of 9-1-1 calls are related to a scenario where local VoIP service providers interconnect with 9-1-1 Selective Routers in a traditional way – i.e. by constructing 9-1-1 interconnection facilities using MF or ISUP trunking in each PSAP serving area where they offer fixed local VoIP services. Currently many VoIP service providers connect incoming calls to their customers located in certain regions of the country by purchasing Long Distance services from other carriers. In these cases, the VoIP carriers may not have a Point of Presence in this region, nor interconnection facilities to that region's 9-1-1 Selective Router. Alternatives to the traditional 9-1-1 interconnection techniques discussed in the CISC 9-1-1 ESWG include establishing IP-based interconnection on 9-1-1 Selective Routers, as well as the possibility of interconnecting 9-1-1 Selective Routers with a nation-wide IP network that would eliminate the need for VoIP service providers to construct and implement dedicated 9-1-1 interconnection facilities at every PSAP serving area.

70.   An agenda item was scheduled at the September 2005 CISC Emergency Services (9-1-1) Working Group to review the Interconnection Support Document which may encompass certain issues outlined in this report. Unfortunately the time available did not permit this item from being addressed – it has been rescheduled for the October meeting.

71.   Bell has confirmed that their network can currently handle Wireless Phase I E9-1-1 which supports the passing of two 10-digit numbers (ANI and pANI). It has been confirmed that all ILECs except SaskTel have this capability for wireless.

72.   The effort involved to introduce 10-digit 9-1-1 call routing could be considered moderate, and the time frame required would be estimated as less than 6 months. For those carriers that elect to convert existing MF facilities on their 9-1-1 Selective Router directly to ISUP facilities (perhaps in anticipation of future requirements), the effort involved would be considered medium to high, and the time frame required would be estimated as less than 12 months.

3.4   PSAP Impact

3.4.1 ALI Record Update/Correction

73.   A valid process is necessary to ensure that PSAPs can facilitate ALI record verifications and updates as required when errors or omissions are encountered. The requirement for access to current and accurate subscriber records and data correction procedures is a public safety responsibility irrespective of the type of technology used to provide local voice and 9-1-1/E9-1-1 services. Optimally, there would be no need to 'reinvent the wheel' – wherever possible existing ALI record update/correction processes might be utilized as a practical foundation for future requirements.

74.   This important issue applies to all local VoIP services and is not specifically related to the introduction of Fixed/Non-Native local VoIP service.

3.4.2 Trouble Reporting

75.   A valid process is necessary to ensure that PSAPs can facilitate ALI record verifications and updates as required on a 7x24 basis when errors or omission are encountered. Processes for other trouble reporting activities are also required, such as the ability to inform a local VoIP service provider of a line that is generating an influx of 9-1-1 calls, or a 9-1-1 call that is misrouted to the wrong PSAP and also to ensure that appropriate follow-up takes place to ensure that these issues are resolved in a timely fashion.

76.   This issue, although important, is not specifically related to the introduction of Fixed/Non-Native local VoIP service.

3.4.3 LSPID

77.   Refer to Section 3.1.6

3.4.4 CAD Data Stream

78.   Computer Aided Dispatch (CAD) systems are used by many PSAPs to aid in the rapid deployment of emergency services personnel. The only potential issue identified to date related to Fixed/Non-Native local VoIP service has been the possibility that a particular CAD platform may be unable to accommodate non-native NPAs due to some type of data input restriction or information display capability. In particular, some CAD systems were known to be limited to 7-digit display of numbers.

79.   Although CAD systems provide significant public safety benefits, not all PSAPs have deployed them. Computer Aided Dispatch can be considered an enhancement to E9-1-1 services; however implementation of CAD is not considered a requirement to be classified as an E9-1-1 service provider. In the cases where CAD has been implemented, not all incoming 9-1-1 calls can currently benefit from the advantages that CAD provides.

80.   Although not all 9-1-1 service providers clarified what limitations, if any, their existing CAD systems may have in terms of support for non-native numbers, it appears possible that no changes to existing CAD systems may actually be required in the majority of cases. As compared to the effort involved to modify database structures or implement support for new protocols, the actual coding effort needed to loosen existing CAD data input validation rules slightly would be considered minimal.

81.   Changes to CAD systems typically require capital budget approvals and documented change requests. The time frame required to schedule and facilitate these changes is difficult to estimate based on the many and varied PSAP organizations and their associated management, resources, budgets, etc.   The time frame is also dependent on individual CAD vendors, software release levels and the ability to upgrade an existing system. Based on these considerations, it could require as little as a few months in the case of a minor software upgrade, to years in the case of a requirement to replace an existing CAD system. Further, funding related issues may significantly affect the overall time frames needed to schedule and implement required changes. Based *solely* on the estimated effort required to modify any existing CAD data stream or display limitations, the time frame would be estimated as less than 4 months. However, as noted above, funding related issues may significantly affect the overall time frames needed to schedule and implement changes where required.

3.4.5 Staff Training

82.   A level of training along with the issuance of PSAP communications bulletins will be desirable for PSAP staff to accommodate Fixed/Non-Native local VoIP service introduction. Although PSAP staff have become accustomed to seeing ALI records with non-native telephone numbers (due to roaming wireless subscribers), Fixed/Non-Native local VoIP service appears to be the first service that may populate traditional ALI records with out-of-region NPA-NXXs. PSAP bulletins will also be necessary if Class of Service codes are introduced or updated, as well as for any other VoIP specific changes to PSAP operations.

83.   Based on the current assessment of the PSAP impacts related to Fixed/Non-Native local VoIP introduction, the effort involved providing training or information bulletins to the PSAPs would be considered minimal. However, as a rule, training is a constant and on-going activity for PSAP staff.

3.5   Cost

3.5.1 PSAP Long Distance Charges

84.   The proposed introduction of Fixed/Non-Native local VoIP service may impact the PSAPs from the standpoint of potential Long Distance (LD) charges incurred when the PSAP agent is required, by virtue of Agency specific policies, to re-call a disconnected 9-1-1 caller, either using the callback feature or by simply dialing the caller's ANI. Currently LD charges apply when a PSAP agent uses an administrative line to place a call over the PSTN to a subscriber geographically located in the PSAP's serving area, but possessing a non-native (potentially out-of-province) number.

85.   If the introduction of Fixed/Non-Native local VoIP service results in PSAP LD charges that cannot not easily be avoided, waived or refunded, this issue may become a PSAP funding related concern. Some of the PSAPs have confirmed that LD charges have become an escalating operating cost where the callback feature is used in conjunction with a Wireless E9-1-1 Phase I scenario.

86.   More investigation of this issue may be required to categorize the precise impacts related to Fixed/Non-Native local VoIP service, however it would appear at this time that any efforts necessary to address issues related to PSAP LD charges would be considered minimal. The time frame required to resolve the issue of PSAP LD charges for Fixed/Non-Native local VoIP service would be estimated as less than 6 months.

3.5.2 911 Rate Collection/Network Access Charge

87.   Refer to CISC Emergency Services (9-1-1) Working Group TIF #42.

88.   A question was raised in a recent CISC Emergency Services (9-1-1) Working Group meeting regarding whether costs related to providing 9-1-1/E9-1-1 service for Fixed/Non-Native local VoIP service will be included in the 2006 9-1-1 rate recalculation. In Telecom Order CRTC 2000-630, the Commission indicated that "according to the formula set out in Decision CRTC 99-17, the 9-1-1 rate is to be recalculated by dividing the 9-1-1 revenue (obtained under the former rate structure) by a new estimate of demand, which would now include WSP and Centrex working telephone numbers. The Commission directed the companies to use actual demand information for the month of September for the recalculation and to file the proposed recalculated rates by 1 December of each year".

3.5.3 PSAP Cost Recovery Capital/Operating

89.   Cost recovery applies to the municipal/provincial fees that cover the PSAP's operating and capital costs. Erosion of this basis of PSAP funding is of serious concern to those levels of government.

90.   For more information, refer to CISC Emergency Services (9-1-1) Working Group TIF #42.

3.6   Risk

3.6.1 Liabilities

91.   Certain potential liability related issues pertaining to Fixed/Non-Native local VoIP service have been identified, such as the possibility of a local VoIP service provider inadvertently routing 9-1-1 calls to the wrong PSAP (perhaps as a consequence of assigning a non-native number).

3.6.2 Agreements

92.   Certain agreement related issues pertaining to Fixed/Non-Native local VoIP service have been identified, such as a requirement to not assign unauthorized NPA codes.

3.7   Customer Notification

3.7.1 Notification

93.   E9-1-1 related public notification requirements for Fixed/Non-Native local VoIP should be minimal, based on the fact that the introduction of E9-1-1 support provides generally well-understood enhancements to the existing Basic 9-1-1 service currently offered for Fixed/Non-Native local VoIP service. If anything, public notification related to the currently existing Basic 9-1-1 limitations related to Fixed/Non-Native local VoIP service would be more essential.

94.   Public education is an ongoing requirement of Public Safety Agencies. Expanding the public education agenda to include any and all types of VoIP-related 9-1-1 or E9-1-1 services increases these costs.

95.   Based on the current assessment of the notification requirements related to Fixed/Non-Native local VoIP introduction, the effort involved would be considered minimal, and the time frame required would be estimated as less than 3 months.

3.8   Restrictions/Obligations

96.   Certain restrictions/obligations related issues pertaining to Fixed/Non-Native local VoIP service have been identified, such as the need to potentially limit non-native numbers to those using authorized Canadian NPAs only.

3.9   Regulatory impacts

3.9.1   Unbundling

97.   No unbundling related issues pertaining specifically to Fixed/Non-Native local VoIP service have been identified or communicated to date.

3.9.2 Call Answer Levy (Municipal or PSAP Charge)

98.   Refer to CISC Emergency Services (9-1-1) Working Group TIF #42.

3.9.3. Agreements

99.   Certain agreements related issues pertaining to Fixed/Non-Native local VoIP service have been identified, such as 9-1-1 interconnection and 9-1-1 call routing availability and requirements.

3.9.4 Tariffs

100.   Refer to CISC Emergency Services (9-1-1) Working Group TIF #42.

3.10 Other Impacts

3.10.1   Non-Canadian NANP Numbers

101.   As previously described in Section 3.2.3, current limitations regarding the maximum number of NPAs allowed on existing 9-1-1 network switching equipment may delay or prevent the introduction of E9-1-1 service for Fixed/Non-Native local VoIP subscribers provisioned with non-Canadian NANP numbers. This issue will be re-visited in the 12 month report.

3.10.2   Services with the Potential for Cross-Border Coverage (e.g. WiMAX)

102.   An issue was raised in a recent CISC Emergency Services (9-1-1) Working Group meeting regarding the possibility of VoIP services being provisioned on wireless (e.g. WiMAX) or other technologies that would allow a

subscriber located in one region to inadvertently connect to a PSAP located in a different region as a consequence of their wireless service coverage area.

103.   This issue does not appear to apply specifically to Fixed/Non-Native local VoIP service, as issues related to roaming (either by location or by service provider) would not apply to a 'fixed' local VoIP scenario.

4   Alternative E9-1-1 Technologies

104.   To date, the Commission has mandated full E9-1-1 support for Fixed/Native local VoIP service, and Basic 9-1-1 support for Fixed/Non-Native and Nomadic local VoIP service. The majority of the CISC Emergency Services (9-1-1) Working Group discussions to date regarding the implementation of E9-1-1 service for Fixed/Non-Native local VoIP service have focused on adapting the existing E9-1-1 platforms (consisting of 9-1-1 Selective Routers, ALI databases, etc.) to the Non-Native case. As E9-1-1 solutions are explored and evaluated for the Nomadic case, applicability of the Nomadic solution to the Fixed/Non-Native case may eliminate the need to adapt existing 'legacy' platforms to the Non-Native case. In particular, the Interim (i2) and NG9-1-1 (i3) initiatives being spearheaded by NENA may have potential merit for the Canadian market.

105.   Further information regarding issues, solutions and suggested implementation timeframes for E9-1-1 service related to Nomadic VoIP services will be provided in the "12-Month" report to the Commission, scheduled for release prior to April 4, 2006.

5   Summary

106.   Good progress has been made to date by the CISC Emergency Services (9-1-1) Working Group with respect to identifying issues that may impact the provision of Fixed/Non-Native local VoIP service. There is agreement amongst

the parties that several important issues currently prevent local VoIP service providers from providing E9-1-1 service to Fixed/Non-Native VoIP subscribers.

107.   Based on a preliminary assessment of all possible issues identified to date and outlined in the Section 3, there is general agreement that the following items are absolutely *critical* and *must* be addressed by all parties:

- ALI/DBMS – data input validation rules
- 7-digit vs. 10-digit routing
- Network hardware limitations e.g. SRDB/SNPA tables
- 9-1-1 selective and default routing

Appendix A - Acronyms

ALI	Automatic Location Identification
ANI	Automatic Number Identification
CAD	Computer Aided Dispatch
CAS	Call path Associated Signaling
CCS7	Common Channel Signaling 7
CISC	CRTC Interconnection Steering Committee
CLEC	Competitive Local Exchange Carrier
CIP	Consumer Internet Protocol
CRTC	Canadian Radio-television and Telecommunications Commission
DBMS	Database Management System
ESCO	Emergency Service Central Office
ESN	Emergency Service Number
ESWG	Emergency Services (9-1-1) Working Group
ESQK	Emergency Service Query Key
ESZ	Emergency Service Zone
ILEC	Incumbent Local Exchange Carrier
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
LD	Long Distance
LEC	Local Exchange Carrier
LERG	Local Exchange Routing Guide
LSP	Local Service Provider
LSPID	Local Service Provider Identification
MIP	Managed Internet Protocol
MF	Multi-Frequency
NANP	North American Numbering Plan
NANPA	North American Numbering Plan Administration
NENA	National Emergency Number Association

NPA	Numbering Plan Area (represented by an Area Code)
NXX	the first 3-digits of a 7-digit telephone number where the first digit cannot be 0 or 1, and the remaining digits can range from 0 to 9
pANI	pseudo ANI
PSAP	Public Safety Answering Point
PSTN	Public Switched Telephone Network
SNPA	Serving Numbering Plan Area
SRDB	Selective Routing Database
TIF	Task Identification Form
URL	Uniform Resource Locator (Internet address)
VoIP	Voice over Internet Protocol
VPC	VoIP Positioning Centre

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