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**Subject: Routing calls to non-geographic numbers**

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**Content:**

**This document entitled “Routing calls to non-geographic numbers” is presented for discussion at CSCN. Among other things, the document addresses the following subject matter from Telecom Regulatory Policy CRTC 2024-26, *Implementing thousand-block pooling*:**

* Para 68: “Further, the Commission expects Canadian carriers to invest resources, exercise leadership, and collaborate as part of CISC working groups to identify and implement effective solutions that reflect a number preservation mindset.”
* Para 95: “With respect to interconnection between carriers for the exchange of traffic to and from non-geographic numbers, the Commission considers that mandating interconnection for the limited purposes described by Bell Canada and RCCI (e.g., SMS, IoT/M2M, and data roaming) would help slow geographic number exhaust by allowing TSPs to provide non-geographic numbers to consumers for these services.”
	1. **INTRODUCTION**
1. Exchange consolidation has been proposed on numerous occasions as a means of conserving numbering resources.  The savings would come from eliminating the inefficiency in assigning a block of numbers for even the smallest of exchanges.  However, exchange consolidation is an impracticable solution because it could require rerating retail services, changing the status of retail regulation in exchanges, and/or implementing new mandated voice interconnections where such interconnections serve areas defined by exchanges.
2. The concept described in this discussion paper does not feature exchange consolidation. Rather than changing the existing geographic PSTN, it contemplates (1) the creation of a non-geographic PSTN (or, more accurately, a non-geographic portion of the PSTN) using the NPA 6YY codes (“non-geo PSTN”) and (2) the establishment of communication between the geo PSTN and non-geo PSTN to support voice and SMS communications between devices with geo and non-geo telephone numbers.  The communication could be achieved through existing mandated local and toll interconnection regimes (or through alternative arrangements negotiated between carriers) and could be supported with either TDM or IP. This connectivity could also support the provision of voice services using non-geo numbers, allowing a service provider to offer nationwide service with a single non-geo CO code.

***Figure 1: Geo PSTN and Non-Geo PSTN***



1. The potential for communication between devices with geo and non-geo numbers has been dismissed in the past because the geo PSTN generally requires a called number to be associated with a geographic location for routing and rating purposes.  (Toll-free is an exception to this generality.) This concept would resolve that issue by designating all calls from the geo PSTN to non-geo numbers as local for the purposes of call routing, and making the non-geo carrier responsible for picking up the call anywhere in Canada.  (The latter part is similar to legacy arrangements for equal access and toll-free calling.)  By resolving that issue, communication between geo and non-geo devices would become universally available, at least within Canada. It would also be possible to (1) assign non-geo numbers to IoT devices that need communication with the geo PSTN and (2) offer voice services without the numbering inefficiency that is inherent in geographic number assignment.
2. In this concept, carriers could continue to operate in the geo PSTN as they are today, with minimal changes.  Carriers choosing offer service with non-geo numbers (solely or in addition to geo numbers) would carry most of the burden.  This would create an opportunity for services and customers to be migrated to the non-geo PSTN according to market demand and relative efficiency.
3. For clarity, this discussion includes WSPs and WLECs networks as part of the PSTN.
4. This discussion assumes the following (unless stated otherwise):
* Carriers offering services with non-geo numbers will negotiate among themselves any required interconnections for the purposes of interchanging voice calls and text messages to their respective non-geo numbers, as required.
* Carriers offering services with non-geo numbers will be LECs nationally, or in most exchanges. This assumption was made because most traffic is interchanged between carriers that are LECs, on a peer basis. (National interconnection is discussed further below.)
* Non-geo 6YY numbers will be 10 digits long. Devices with 12 or 14-digit numbers (as the CSCN is currently recommending for some 6YY codes in the future) would be able to call the geo PSTN, but the reverse would not be true without significant modifications to the geo PSTN.
1. This discussion uses examples with legacy regulated TDM interconnection arrangements, rather than IP/SIP. This is partly because legacy arrangements are well documented, but also because they represent the lowest common denominator among Canadian carriers. Calls to non-geo numbers could be completed even if originated where only TDM interconnections are available. IP/SIP interconnections are not discussed, but would generally make everything cheaper and simpler.
2. This discussion refers to CO codes throughout, even though thousand blocks will be available in the near future. The use of blocks instead of codes would not affect the viability of the concept.
3. In this discussion, the term “geo service” means service provided with a geo number, while “non-geo service” means service provided with either a non-geo number or a geo number ported to a non-geo LRN (*i.e.*, not a new kind of retail service).   New rates, terms, conditions or regulatory status for retail services (for data or voice) are not discussed or implied, and should not be inferred.  No changes to the rates, terms, conditions or regulatory status for retail services are required to support call routing to non-geographic numbers.
4. The concept has three stages. All three feature connectivity between the geo PSTN and the non-geo PSTN, but differ in terms of the level of service enhancement available and potential improvements in numbering efficiency.

Stage 1: Communication with no additional number portability

Stage 2: Communication with number portability between non-geo devices

Stage 3: Communication with number portability between geo and non-geo devices

1. Whether the public interest would be best served by implementing any or all of these stages is a policy matter. No positions on policy matters are presented in this discussion.

**1.1 The Non-geographic PSTN**

1. The non-geo PSTN would be created by designating all 10-digit 6YY numbers as dialable from the PSTN. This would require that the codes be opened in the geo PSTN by all service providers, allowing these numbers to be dialed.
2. To the extent that non-geo devices operate with 6YY numbers today, they should be unaffected, because they were deployed under the assumption that the applications they support do not require voice calls from the geo PSTN. However, there are many IoT devices which have geo numbers assigned, specifically for the purpose of receiving voice calls or texts from the geo PSTN. This would no longer be required under any of the stages discussed below.

**1.2 National Carriers**

1. The requirement to be a national carrier differs by the service requiring support. Many carriers achieved national coverage to offer toll-free services by connecting to all the designated ILEC toll-free switches. Similarly, many carriers achieved national coverage to offer competitive long distance service by connecting to all the ILEC access tandem switches.
2. Truly national carriers for the non-geo PSTN would be LECs in every exchange in Canada (an assumption in this discussion, unless otherwise stated). In reality, separate arrangements might be required to reach the most remote exchanges. Alternatively, regional coverage and connectivity could be considered by carriers, depending on the applications offered. This discussion does not explore regional coverage or connectivity.
3. Carriers without national scope would have an opportunity to acquire it through wholesale services offered by a national carrier. Such arrangements are not discussed in this paper.

**2.0 STAGE 1: CoMMUNICATION with no additional number portability**

1. There is no number portability for 6YY numbers today. Stage 1 does not change that. It only establishes communication between the geo PSTN and the non-geo PSTN.
2. Figures 2 and 3 show how the routing and carriage obligations for a call from Halifax to Vancouver would differ for termination to geo numbers (as is done today) and to non-geographic numbers in Stage 1. These are typical arrangements to demonstrate the differences between calls to geo and non-geo numbers. Other arrangements are possible.

***Figure 2: Call routing to a geo number***

 

1. Figure 2 shows the current routing responsibilities for a typical call from Halifax to a device with a geographic Vancouver number. Carrier A (the originating carrier) identifies the terminating exchange by the dialed number and carries the call to Vancouver. In Vancouver, Carrier A performs an LNP query for the dialed number to determine the terminating carrier and completes it to Carrier B (the terminating LEC).
2. Carrier B expects that the call will be delivered in Vancouver, either through local or toll connections, and (under the assumption that Carrier B is a LEC in Vancouver) that it gets paid for terminating the call either way. If the called device is not in Vancouver (because it is mobile or VoIP, for example) Carrier B carries the call from Vancouver to wherever the device is, at its own expense.
3. It is possible that Carrier A sends the call to a third party for inter-exchange transport (by choice or due to Equal Access obligations), but Carrier B still expects to receive the call in Vancouver and be paid for termination.
4. It is also possible that Carrier A performs the LNP query earlier in the call flow. However, the call still must be delivered to Carrier B in Vancouver.

***Figure 3: Call routing to a non-geo number in Stage 1***



1. Figure 3 shows the call routing for the same call, except that the terminating device has a non-geo number. In Stage 1 (where there is no portability for non-geo numbers) Carrier A identifies the terminating carrier by the CO code. In the absence of portability, no LNP query is required.
2. Once Carrier A identifies Carrier B as the terminating carrier, it routes the call to Carrier B immediately, over the existing arrangements it has for terminating calls to Carrier B’s customers in Halifax, and pays Carrier B the local terminating rate. This is consistent with local call routing.
3. Carrier B could no longer expect that the call will be delivered in Vancouver, because Carrier A has no way of determining the location of the terminating device. As a carrier offering non-geo numbers, receiving voice calls, Carrier B would have to be prepared to accept calls to its non-geo numbers from anywhere in Canada. Carrier B would expect to be paid for termination if it receives the call in an exchange where it is a LEC, but it would still be responsible to carry the call from the interconnection point to the terminating device at its own expense.
4. In cases where traffic volumes do not justify the necessary interconnections to support CLEC status, Carrier B could elect to receive the calls through toll arrangements, such as through an ILEC Access Tandem. To support this arrangement, Carrier A would need to be able to route calls to the ILEC access tandem if there is no local connection to Carrier B. In this case, Carrier B would have to pay switching and aggregation rates for calls received, but would have the option (and a financial incentive) to establish CLEC interconnections at any time.

**2.1 Stage 1: Benefits and Drawbacks**

1. Stage 1 would have the following benefits:
* There would no longer be a requirement for IoT devices to get geo numbers, because voice calling from the geo PSTN would be supported to and from 10-digit non-geo numbers. This would save geo codes and would make number assignment easier for IoT carriers in that all IoT devices could all be assigned 6YY numbers.
* Voice service could be offered with non-geo numbers with a single CO code serving the whole country. This would eliminate the numbering inefficiency in assigning a minimum block size in small exchanges, and would be easier for carriers to administer.
* Communication would be achieved with minimal changes to the geo PSTN, effectively relieving carriers who have no interest in offering non-geo services from most of the costs associated with establishing communication between the geo PSTN and the non-geo PSTN.
1. Stage 1 would have the following drawback:
* In the absence of portability, voice service customers with non-geo service would have to be assigned non-geo numbers, instead of retaining their current numbers. If they decided to change service providers, they would have to change numbers. This would limit the public acceptance of non-geo voice service.

**3.0 STAGE 2: Connectivity with number portability between non-geo devices**

1. In Stage 2, number portability is added for non-geo numbers. (For clarity, this does not include portability between geo and non-geo services.) Each national carrier would have a non-geo LRN based on its non-geo NXX code. This non-geo LRN would be the same for all its non-geo customers.
2. Figure 4 shows the routing and carriage obligations for a call from Halifax to Vancouver in Stage 2.

***Figure 4: Call routing to a non-geo number in Stage 2***



1. In Stage 2, non-geo numbers are portable. As a result, Carrier A would have to perform an LNP query to determine the terminating carrier. Once Carrier A identifies Carrier B as the terminating carrier, the call flow and settlement would remain the same as in Stage 1. Again, this is consistent with local call routing.

**3.1 Stage 2: Benefits and Drawbacks**

1. Stage 2 would have the following benefits:
* Portability of non-geo numbers would mean that customers of non-geo voice services could port their numbers to another non-geo voice provider. This could increase the public acceptance of non-geo voice service.
* All the benefits of Stage 1.
1. Stage 2 would have the following drawback:
* In the absence of portability between the geo PSTN and non-geo PSTN, voice service customers changing to non-geo service would have to be assigned non-geo numbers, instead of retaining their current geo numbers. This would continue to limit the public acceptance of non-geo voice service.

**4.0 STAGE 3: Connectivity with number portability between geo and non-geo SERVICES**

1. In Stage 3, number portability is added between geo and non-geo services, allowing a carrier offering non-geo service to port geo numbers to its non-geo LRN. Call routing could differ depending on whether the dialed number is geo or non-geo, ported or not.
2. Routing for calls to geo numbers that have not been ported to a non-geo LRN would be the same as current routing in the geo PSTN, as shown in Figure 2.
3. Routing for calls to non-geo numbers would be that same as in Stage 2, as shown in Figure 4. Carrier A would still recognize the dialed number as non-geo, perform an LNP query and route the call to the national carrier as a local call in Vancouver.
4. Routing for calls to geo numbers that have been ported to a non-geo LRN would normally be routed as in Figure 2. Carrier A would see the dialed geo number and route the call to the terminating exchange, where the LNP query would be performed. The LNP response would contain Carrier B’s non-geo LRN and the call would be routed to Carrier B locally in Vancouver.
5. If Carrier A has chosen to perform LNP queries at the start of the call, the call could also be routed to Carrier B in Halifax. Again, national carriers would have to be prepared to receive the call in any location.

**4.1 Stage 3: Benefits and Drawbacks**

1. Stage 3 would have the following benefits:
* Consumers could keep their current geo phone numbers when switching to non-geo service, increasing the likelihood of wide public acceptance.
* A carrier offering non-geo service could port customers in from anywhere in the country without requiring local geo LRNs, and therefore not requiring local geo codes or blocks of numbers. This could improve numbering efficiency.
* Established carriers could choose to assign non-geo numbers to new customers, reducing demand on geo codes already assigned and deferring their exhaust.
* All the benefits of Stage 1.
1. None of the drawbacks of Stages 1 or 2 would apply to Stage 3.

**5.0 CONCLUSION**

1. Creating a non-geo PSTN by using the currently available 6YY numbers presents opportunities for numbering efficiency. These opportunities could be achieved through existing mandated interconnection regimes.
2. The creation of a non-geo PSTN would not require all carriers to offer non-geo services. Any carrier could choose to continue to offer only geographic service in the geo PSTN. This minimizes the changes required by non-participants.
3. The CISC should consider the creation of a non-geo PSTN as a mechanism for establishing communication between the geo PSTN and IoT devices that require voice connectivity, and as a mechanism for reducing numbering inefficiencies associated with geographic number assignment.

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