Network Working Group
Internet-Draft
Intended status: Informational
Expires: 31 October 2026

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29 April 2026

A Proposal for Long-Term Expansion of the North American Numbering Plan (NANP) to 11 Digits
draft-robinson-nanp-expansion-01

Abstract

The North American Numbering Plan (NANP) is projected to exhaust available telephone numbering resources within the coming decades under current allocation and utilization trends. Existing mitigation strategies, including area code overlays and number pooling, extend the usable life of the NANP but introduce increasing operational complexity and user confusion.

This document proposes a long-term, uniform expansion of NANP telephone numbers from 10 to 11 digits through extension of the area code or Numbering Plan Area (NPA) from 3 to 4 digits. The proposal emphasizes backward compatibility, fixed-length numbering, and a multi-phase transition strategy designed to minimize disruption. This document is intended to stimulate discussion and does not represent the position of any standards body or regulatory authority.

About This Document

This note is to be removed before publishing as an RFC.

Status information for this document may be found at https://datatracker.ietf.org/doc/draft-robinson-nanp-expansion/.

Source for this draft and an issue tracker can be found at https://github.com/electric-socket/11digitdialing.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

The NANP currently utilizes a fixed-length 10-digit numbering format (NPA-NXX-XXXX). Growth in telecommunications services, device proliferation, and number portability has steadily increased demand for numbering resources.

Mitigation strategies such as overlays and thousands-block number pooling have delayed exhaustion but introduce increasing complexity in routing, administration, and user experience.

This document explores a uniform expansion of NANP numbers to 11 digits as a long-term solution.

This proposal preserves fixed-position digit parsing, avoiding variable-length interpretation and timing-based ambiguity. This property is a primary design objective, as it minimizes required changes to existing switching and routing infrastructure.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Definitions

CP: is Cellular Provider, the service provider for a caller using cellular telephony.

IXC: Interexchange Carrier - the organization that carries a call

between the caller’s service provider and the called party’s service provider where the caller’s service provider does not serve the area of the called party.

Jeopardy: Jeopardy is the condition where an NPA is in danger of running out of available NXXs to use for new telephone subscribers, requiring a freeze on the issuance of further subscriber numbers in that NPA until more NXXs become available.

LEC: Local Exchange Carrier, the service provider for a caller using a landline or VoIP service, the organization that provides dial tone and carries a call to the called party where they are within the service area of the LEC, or transfers the call to an IXC when the called party is outside its service area.

N versus X: In the context of a telephone number, N is used to indicate a digit that is restricted to values of 2 through 9, while X indicates an unrestricted digit with values 0 through 9.

NPA: The area code, or first three digits of the 10-digit telephone number. This document will use both ’area code’ and ’NPA’ interchangeably, generally with NPA used when discussing technical and implementation issues, and area code being used when discussing issues faced by subscribers and the public.

NPAX: The new area code, or first four digits of the new 11-digit telephone number. This proposal recommends expansion of the NPA field by 1 digit and provides an expansion of the entire telephone number to 11 digits.

NXX: The prefix, or digits four through six of the 10-digit telephone number, or first three digits of the subscriber number. This field is to remain unchanged, but is moved to digits five through seven of the new 11-digit telephone number.

SIT tone: A Special Information Tone (SIT) is a standardized, three-beep audio signal (typically 950/1400/1800 Hz) played before a recorded announcement to indicate a telephone call has failed.

Subscriber number: The portion of the telephone number following the NPA or NPAX. It remains unchanged at seven digits, but is moved from positions four through ten of the telephone number, to positions five through eleven.

Telephone number: The entire number of the party to be called, consisting of either

* On 10-digit systems, the three-digit NPA, three-digit NXX, and four-digit XXXX.

* On 11-digit systems, the four-digit NPAX, three-digit NXX, and four-digit XXXX.

VoIP: Voice Over IP, or telephone service where the call initiates from or terminates via the Internet.

XXXX: The last four digits of the subscriber number, or line number, digits seven through ten of the 10-digit telephone number. This field is also to remain unchanged, but is moved to digits eight through eleven of the new 11-digit telephone number.

4. Problem Statement

The current NANP faces several challenges:

* Finite NPA capacity under existing numbering rules

* Fragmentation of numbering resources due to allocation practices

* Growing operational complexity in routing and database systems

* Long lead times required for major numbering plan changes

A long-term solution should address these challenges while minimizing disruption to existing systems and users.

All feasible approaches to expanding NANP numbering capacity introduce some degree of disruption. The proposed expansion of the NPA is considered the least disruptive option, as it preserves the existing hierarchical structure of the numbering plan and minimizes changes to subscriber numbering and routing semantics.

5. Design Goals

The proposed solution is guided by the following goals:

* Maintain fixed-length numbering

* Minimize changes to existing routing logic

* Preserve compatibility with existing numbering structures

6. Non-Goals

The following approaches are explicitly not considered desirable:

* Variable-length telephone numbers

* Region-specific numbering formats

* Frequent or repeated structural changes to the numbering plan

* Solutions requiring rapid or "flash cut" transitions

7. Proposed Expansion Model

This document is a proposal to expand NANP numbers from 10 to 11 digits by extending the NPA from three digits to four digits. This ensures that existing fixed-position digit parsing logic can be extended with minimal modification, avoiding the need for timing-based or variable-length interpretation.

Existing numbers:

NPA-NXX-XXXX

Expanded format:

NPAX-NXX-XXXX

During initial deployment, the fourth digit added to the NPA to form the NPAX MUST be selected such that it does not conflict with existing digit patterns used to identify the first digit of NXX codes. Under current NANP rules, the first digit of an NXX is restricted to values 2 through 9.

By selecting 0 or 1 for the additional NPA digit, the boundary between the expanded NPAX and the following NXX remains unambiguous. This allows existing digit analysis algorithms to distinguish between legacy 10-digit and expanded 11-digit numbers using a simple examination of the fourth digit.

Restricting the fourth digit initially to a single value minimizes required changes to routing logic and reduces deployment cost.

This property allows existing fixed-position digit analysis logic to be extended with minimal modification, avoiding the need for timing-based disambiguation, interdigit timeout adjustments, or variable-length parsing mechanisms.

A single value (0 or 1) SHALL be used consistently across all NPAs during the initial deployment phase to ensure uniform behavior across networks. Uniformity avoids user confusion, simplifies parsing, and prevents mixed national behavior during migration.

Example:

213-555-1234 (legacy)

2130-555-1234 (expanded)

Or:

303-555-1234 (legacy)

3031-555-1234 (expanded)

A telephone switching system processes a telephone number using the following logic:

1. Scan fourth digit of number.

2. If 0 or 1, process as NPAX.

3. Else, process as NXX.

This proposal preserves the semantic structure of the number.

* NPAX is still geographic.

* NXX is still used as the routing block.

* XXXX is still the subscriber line number.

The widespread adoption of overlay area codes has fundamentally altered the NANP environment. A return to strictly geographic, non-overlapping area codes is no longer practical. The proposed approach assumes the continued existence of overlays and does not attempt to reverse this trend.

The designation of 988 as a nationwide service code required the elimination of 7-digit dialing in affected areas, accelerating the transition to uniform 10-digit dialing across the NANP. As a result, this proposal does not impact legacy 7-digit dialing, as that capability has already been largely eliminated.

This approach ensures that numbering expansion occurs at the highest level of the NANP hierarchy, avoiding disruption to lower-level components such as routing prefixes and subscriber numbers.

This method preserves fixed-field positional parsing, avoiding the need for timing-based digit collection or variable-length interpretation, which are known sources of complexity and error in telephony systems.

8. Human Factors

During and after transition, published numbers SHOULD be displayed in hyphenated 4-3-4 form (e.g., 2130-555-1234). Users will find this format similar to the existing 3-3-4 format, and are expected to adapt to the new format following the patterns observed during the transition to mandatory 10-digit dialing. Contact storage systems, dialing interfaces, and automated dialing features are expected to adapt with minimal modification due to the preserved fixed-length structure.

9. Routing Considerations

Existing routing systems rely on fixed field positions within the NANP number. The proposed expansion preserves the relative position of the NXX and subscriber line number fields, allowing for minimal modification to routing logic.

Systems that perform digit analysis MUST be updated to recognize the NPAX format. This includes SS7-based switching systems, SIP routing platforms, and number portability databases.

These updates are limited to recognition of the fourth digit as a format discriminator and do not require changes to downstream routing logic based on NXX or subscriber number.

10. Transition Strategy

A phased transition is recommended:

10.1. Phase 0: Infrastructure Readiness

Networks and systems are updated to support 11-digit numbers without public announcement. Switching systems MUST be updated to recognize and correctly route NPAX-based numbers during Phase 0.

There SHOULD be some cross-network communication system such as a website, a mailing list, a help desk, and/or other method for parties involved in the conversion to report progress and to obtain

information helpful in diagnosing problems, issues and events that may require special attention or otherwise require additional resources for resolution. This SHOULD be provided or operated by a neutral third-party.

10.2. Phase 1: Dual-Format Acceptance

Both 10-digit and 11-digit dialing are accepted by all CPs, IXCs, and LECs. All originating and terminating networks MUST accept both formats.

10.3. Phase 2: User Notification

Phase 2 is implemented as two segments.

10.3.1. Segment 1

In Segment 1 of Phase 2, LECs, CPs, IXCs, and regulatory authorities MUST publicize the implementation of the expansion of the NPA to an NPAX, where the area code is expanded to four digits, and the telephone number to eleven digits. An important highlight of the announcement SHOULD emphasize that there will be no change to the subscriber number. It SHOULD also state the date Segment 2 will begin and the date that phase 3 will begin.

10.3.2. Segment 2

In Segment 2 of Phase 2, Intercept messages SHALL be imposed on callers dialing a 10-digit phone number, and such message SHALL inform callers dialing telephone numbers using the current 10-digit format of upcoming requirements, MAY inform them of the digit they need to append to the area code, and SHOULD state the date when dialing the new 11-digit number will be required. The call SHALL still complete.

10.4. Phase 3: Mandatory Expansion

11-digit dialing becomes required. Callers dialing the old format 10-digit number SHALL be presented with an intercept message beginning with a SIT tone and an announcement that they must dial the new 4-digit area code. The message MAY announce the additional digit that MUST be dialed. The call SHALL NOT complete, and SHALL be treated equivalently to dialing an invalid number.

10.5. Phase 4: Full Expansion

The fourth digit of the NPA is opened to all values 0 through 9, increasing numbering capacity.

11. Alternatives Considered

The following alternatives were evaluated:

11.1. Further subdivision of number pooling blocks

Further subdivision of pooling blocks provides only limited extension while increasing database and administrative complexity.

11.2. Expansion using only reserved NPA ranges (e.g., N9X)

If the rest of the available NPAs are exhausted, this becomes a stop-gap measure until this or some other planned expansion of the telephone number to 11 digits.

11.3. Overlay NPAs

Originally each NPA covered one region exclusively. As more telephone numbers were needed, more NXXs were added until no more were available. The answer at that point is to split the NPA, take about half the NXXs that were geographically adjacent to each other, and assign them to the new NPA. The advantage was the subscriber number did not change, so local seven-digit dialing was unaffected, and the subscriber simply had to advise people that their area code had changed. This practice worked when regions were large and the remaining regions after the split are of a reasonable size. When they are city-sized or smaller, splitting NPAs produces a point of diminishing returns, where an NPA might only be part of a city.

The switch to overlays alleviated this problem as now the combined number pool of both NPAs is available for the entire region. It also ends the dilemma of an NPA in jeopardy status being split, with one NPA having more than sufficient available NXXs and the other remaining in jeopardy. Overlays were inevitable and solved the problem of an NXX surplus/starvation NPA split result dilemma.

While overlays are useful, and it is very likely new NPAs will be added as overlays to existing regions, they won’t be enough to solve the problem when it is not NXXs that are in jeopardy, but NPAs.

11.4. Variable-length numbering schemes

These approaches introduce significant implementation complexity, increase validation burden across systems, and may negatively affect user perception of numbering uniformity.

These approaches either provide limited long-term benefit or introduce undesirable complexity.

11.5. Expansion Of NXX To NXXX

The expansion of the subscriber number to 8 digits by increasing the size of the NXX to four digits was considered, but it creates an even larger disruption:

* The number of NXXs in an NPA rises from slightly under 800 to nearly 8,000. It would vastly increase the size and complexity of local number portability databases

* It would also increase the number and size of call routing tables

* Third parties would have to update software for holding much larger number ranges

* The number of potential telephone numbers in an area code rises from around 7,000,000 to nearly 70,000,000

* In most regions this would cause each area code in the state to be many times greater than the entire population of the region served by that NPA. Much of the additional capacity would be unusable or wasted.

11.6. Expansion Of XXXX To XXXXX

The expansion of the line number to 5 digits adds even more complexity and potentially even greater added costs than expanding the NXX to 4 digits:

* Even larger number portability databases, as each NXX expands by a factor of 10

* Local switches have to handle not potentially 10,000 lines for each NXX they service, but 100,000

It is entirely possible switch hardware cannot support this large a number pool, either rewiring replacement or upgrading expensive switching equipment. It may require splitting NXXs onto multiple switches and require even more routing changes to accommodate. In heavily populated urban areas it might require acquisition of additional expensive switches, real estate, and buildings.

12. Operational Considerations

The proposed expansion is designed to minimize impact on:

* Call routing systems

* Number portability databases

* Inter-carrier signaling

However, significant updates would be required in:

* Customer-facing systems

* Validation logic

* Legacy equipment and embedded systems

A question that may arise is "Why not allow the full number range of 0-9 in the fourth digit of the telephone number to be activated immediately, rather than the current proposal to initially only permit a single digit?"

The rationale is cost and complexity. Initial deployment using a single digit minimizes required routing changes. This proposal acknowledges \ that significant costs would be involved in moving to an 11-digit telephone number. Eventually, the change must happen. The fact remains, initially implementing only one digit generates the least amount of cost increase, as only the routing logic of the fourth digit of the telephone number is required to be changed. Later, when digits 2-9 are enabled, the code required to check the fourth digit can then be eliminated. Thus, this also reduces the complexity involved in making this change.

13. Backwards Compatibility Risks

There will need to be lead time to account for, and attention placed on informing owners of systems that may need to be replaced because of incapacity to update them to use the new format telephone number, such as systems using:

* Hard-coded 10-digit fields

* Regular expression validation failure

* Embedded devices

Emergency equipment that sends "final warnings" or notifications need to be considered:

* Elevator telephones

* Audible Burglar alarms

* Silent alarms

* Credit/debit card processing terminals in places where Internet connections are unavailable

* Roadside motorist assistance telephones

Civil emergency response centers will have critical need to make certain proper expansion and adjustment is done for:

* 911/E-911 routing

* PSAP systems

* ALI/ANI databases

Number portability and carrier identification databases must be adjusted to compensate for this change:

* LNP databases are massive, and may require updates to database schemas and query logic in both SQL and NoSQL implementations

* Key lookup structures are dependent on current NPA-NXX format

One advantage this proposal provides is it requires no change to NXX format, preserving existing LNP granularity.

14. Benefits

The current NPA format allows a maximum of 800 NPAs to be implemented (200-999). However, practical considerations reduce this in several ways:

* X11 codes (211, 311, 911 etc.) are unavailable

* 988 as an additional N11-style number (and possibly others in the future) will reduce the supply further

* N9X was reserved for future expansion.

Given these constraints, the maximum number of NPAs is probably more like 700. While this is a large number, it eventually will be exhausted, possibly within the foreseeable future.

Expansion of area codes to add an extra digit, and later full expansion to 11-digits expands the numbering range by a full factor of magnitude, to 8000 possible NPAXs. Assuming similar carve-outs are used:

* N11X is reserved to prevent confusion

* 988X is also reserved

* Other similar service codes to 988 (200, 766, 322, 433 etc) are created, and those code ranges are restricted, e.g. 200X, 322X, 433X

* N9XX is reserved for future expansion

It still leaves a huge pool of available NPAXs. If the X11X, 988X, and 10 additional service code code blocks are reserved, in addition to N9XX, we have

* 72 NPAXs restricted for N11X protection

* 110 NPAXs restricted for 988X protection and 10 additional service code blocks

* 800 NPAXs reserved for N9XX expansion

Leaves more than 7,000 potential NPAXs available for assignment. This represents an approximate order-of-magnitude increase in addressable numbering capacity compared to the current NANP structure.

15. Economic Considerations

15.1. Cost Considerations Of Methods Used

Incremental approaches distribute cost over time but increase long-term complexity. A planned expansion incurs higher initial cost but may reduce cumulative cost and operational burden.

Early planning enables gradual transition and reduces the risk of emergency implementation.

15.2. Billing and Rating Impact

Carriers price call charges (including call origination and termination payments) on

* NPA-NXX

* LATA boundaries

Other than increasing the length of the NPA and temporarily carrying duplicate records (one for the old 3-digit NPA, and one for its replacement NPAX during phases 1 through 3 (much of which can be automated) these impacts are expected to be minimal due to preservation of the NPA-NXX structure used in existing billing and rating systems.

16. Security Considerations

Changes to numbering formats may impact fraud detection systems, call validation mechanisms, and authentication processes. These impacts SHOULD be evaluated during implementation planning.

Number spoofing detection systems, including but not limited to STIR/SHAKEN authentication to take into account both the current, and replacement numbers.

Call authentication assumptions MUST be reviewed and updated to ensure compatibility with both legacy and expanded numbering formats. This represents an approximate order-of-magnitude increase in addressable numbering capacity compared to the current NANP structure.

17. Transition Governance

One or more coordinating authorities MUST be designated to manage key aspects of the transition. These include:

* Whether the NPAX flag digit in position 4 of the telephone number is 0 or 1

* Timeline for start and implementation of each phase and segment of the upgrade plan

* Who will be responsible for enforcing compliance with all mandates?

18. Transition Difficulties

Not all parties involved in the transition will necessarily act as expeditiously as possible. Concerns over depreciation or amortization of existing equipment and/or software will be a serious concern to various organizations and responsible individuals. This may result in compatibility problems with respect to

* "Long tail" legacy systems

* Private Branch Exchange (PBX) systems

* International interoperability lag

As a result, partial deployment conditions may persist long after others are fully ready for the changes as a result of the implementation of 11-digit telephone numbers.

19. International Considerations

The proposed 11-digit format remains compatible with the E.164 [ITU] maximum length of 15 digits. Coordination with international carriers and regulatory bodies is required.

* This change poses no impact to global numbering compatibility

* It fits into the existing +1 country code model

No changes to the E.164 country code (+1) are required.

20. IANA Considerations

This document has no IANA actions.

21. Conclusion

Expansion of the NANP to 11 digits represents a viable long-term solution to numbering exhaustion. Early evaluation and planning are recommended to enable a controlled and gradual transition.

Given the long lead times required for numbering plan changes, early evaluation is necessary to avoid time-constrained or emergency implementation.

22. References

22.1. Normative References

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22.2. Informative References

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Appendix A. Changelog

draft-00:

* Initial Release

draft-01:

* correct misspelling: allowsexisting -> allows existing
* Explain drawbacks of some alternative strategies
* Adjust line lengths to improve ease if editing, to take advantage of kramdown-rfc and xml2rfc automatic reformatting

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