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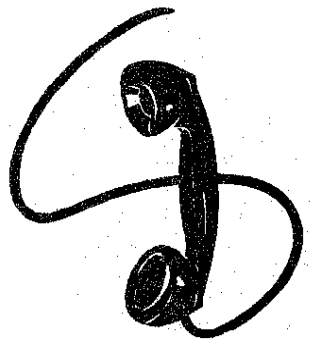
New nation-wide telephone numbering plan



O. Myers

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The New Nation-Wide Telephone Numbering Plan

O. MYERS
MEMBER AIEE

THE PRESENT NATION-WIDE telephone numbering plan, adopted in 1947, was expected to last beyond the year 2000, but now it appears that it will be outgrown by about 1975. The telephone industry in the United States and Canada has, therefore, adopted a new plan with several times the code capacity of the present one which should last well into the next century.

The new plan, shown in Table I, provides uniform dialing procedures for all types of central offices. Under the present plan, procedures vary with the type of office. The following are also provided:

1. A prefix for customer dialed person-to-person, collect, credit card, and other calls requiring operator assistance. The recommended prefix is "0" (zero).

2. A simplified toll office access code for DDD (direct distance dialed) calls in step-by-step central offices. With the present plan a step-by-step central office customer making a DDD call uses a 3-digit access code such as "112" to reach the toll office. The access code may be followed by as many as ten digits giving a maximum of thirteen digits. With the new plan, the recommended DDD access code is the single digit "1" and the maximum number of digits is therefore eleven.

3. A prefix to prevent local intended calls from reaching toll points in error in cities using telephone systems like no. *5* and no. *1* crossbar which store and process the dialed digits (common control type). The new plan requires the use of a prefix, "0" or "1," on all toll calls. Hence a wrong office code digit on a 7-digit local call (no prefix being dialed) cannot convert a local-intended call into a toll call.

Background

The present nationwide numbering plan operates with 152 area codes of the form A1X or A0X (A represents 2 to 9; X represents 0 to 9). Of the potential 160 codes, eight are used for service codes in the series A-1-1. For example, the information code in a common control city is 411. The area code is generally followed by two letters of an office name and five numbers. See Table II for present and ultimate capacities.

With the present practice of using central office names, each area has a capacity of about 540 office codes. It would seem that there should be 640 possible office codes. (Eight dial pulls for the first digit times eight dial pulls for the second digit times ten for the third digit. Only eight holes on the dial have letters.) In practice, however, there are only about 60 usable letter combinations for the first two digits instead of 64. This is because of the difficulty in finding names to fit the dial pulls 5-5, 5-7, 9-5, and 9-7 (5 corresponds to JKL, 7 to PRS, and 9 to WXY). Also, since there is considerable confusion between the letter "O" and the numeral zero, the latter is usually avoided in the central office designation. This leaves us with 60 usable letter combinations multiplied by nine numerals for a total of 540 codes.

Each office code has capacity for 10,000 telephone numbers. The original plan of using office names was recently amended. All-number calling (ANC) is now recommended and 640 codes are available at present in areas that elect to use ANC. The combination of ANC and new dialing procedures will produce 792 office codes.

Eighty-six of the 152 area codes were assigned when operator nation-wide dialing was started in 1947. The remaining 66 area codes were expected to care for many years of growth. However, there has been a telephone explosion in the United States. In the decade 1950–1960, while the United States population grew from about 150 million to 180 million, telephones grew from about 41 million to 71 million. Growth during the next 15 years is expected to be even greater. Telephones are expected to double in number from 71 million to 142 million while population may increase to 237 million.

These data are somewhat misleading. Telephones rather than telephone numbers have been discussed while only the latter affect numbering capacity. Much telephone growth will merely result in an increased number of extensions rather than in more numbers. Some of the

Table I. The New Numbering Plan

	Ultimate Stage	Initial Stage
Home area DDD	1+AXX+4N(numbers)*	(1)+ABX+4N†‡§
Home area special toll	0+AXX+4N	0+ABX+4N
Foreign area DDD	1+*AXX*+AXX+4N‖	(1)+*A0/1X*+ABX+4N
Foreign area special toll	0+*AXX*+AXX+4N	0+*A0/1X*ABX+4N

* A represents 2 to 9; X represents 0 to 9.

†(1) Indicates that the prefix may be used in common control areas but must be used in SXS areas.

‡ In the initial phase, existing type access codes, such as 112, may be retained. Ultimately access codes other than 1 and 0 should be used only where the switching system design requires their use.

§ All-number calling is now recommended; therefore, ABX represents the two letters of the office name followed by a number or three numbers of the recommended all-number office designation. For the present the first two office digits are limited to 2 to 9.

‖ Italicized codes are area codes.

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Table II. Capacity of New Numbering Plan

Initial		
Area codes:	A1/0X	152
Office codes:	ABX (Names)	540
	AXX* (All-Number Calling)	640
Ultimate		
Area codes:	AXX	800
Office codes:	AXX	792†

* X in this case represents the digits 2 to 9. When the new plan is implemented it will represent 0 to 9 and 792 office codes will be available.

† Eight codes in the A-1-1 series are reserved for service codes in common control cities.

Service codes: No change
Operator code: "0"
AHAD permitted: Requires an arrangement to determine whether the number includes an area code.

growth will cause an increase in telephone numbers and, therefore, in office and area codes.

New services will increase the demand for numbers and codes considerably. Today, we need 117 area codes. Most of the increase from the original 86 is due to unanticipated growth. but several area codes were also added for dialing to points beyond the continental United States and Canada such as Hawaii, Alaska, and Puerto Rico. Other new services are also having an effect which will increase as times goes on. Direct inward dialing to PBX (private branch exchanges) is one such service. This requires PBX extensions to have standard 7-digit numbers and results in a telephone number per extension rather than in one per PBX trunk.

Another new service that will require telephone numbers is data switching over the telephone network. Each data station will require one or two numbers, so additional numbers, office codes, and area codes will be added because of this service. Still other uses for area and office codes will be generated by paging systems, mobile systems, military systems, and extension of dialing to additional points.

Requirements of the New Plan

The new plan was devised to meet the following requirements:

Capacity

Additional capacity is a basic requirement. Capacity could be extended for a few years beyond the expected exhaust date with relatively modest changes in the present plan but experience with temporizing has been bad. Underestimations have led to difficulties in the past. It seems sensible to set up a large capacity plan that will last well into the next century. The eight-hundred area codes provided by the new plan are considered adequate. This number of codes is obtained by using eight digits, 2–9, in the first code position and ten digits, 1–0, in the second and third positions.

While we have been thinking primarily in terms of capacity that would be adequate for North America, we have not been unaware of the ultimate desirability of a world-wide plan. The door has been left open for arrangements such as doubled prefix digits which will allow the proposed plan to grow into a world-wide plan.

A Programmable Plan

A plan that would require a simultaneous nation-wide switch from the existing to the new would be completely impractical. Apart from the large costs of such a cutover, the co-ordination of work in thousands of central offices could not conceivably be handled without major difficulties and service interruptions. The plan adopted can be implemented in easy stages.

No Modifications of Customers' Equipment

The chief objection to modifying equipment, such as telephones on customers' premises, is cost. From the standpoint of features certain modifications of telephones are attractive One which has been discussed is the use of specially designated buttons on dials and on keysets proposed to replace dials, which customers would push instead of dialing prefix digits such as "0" or "1." Other changes have also been suggested, but costs have prevented adoption of any of these ideas as a requirement of the new plan.

Costs

Reasonable over-all costs are obviously a necessity. It is also desirable that money be expended only where needed and at the time a change in plan is needed.

Abbreviated Home Area Dialing (AHAD)

The new plan recommends the prefix "1" or "0" followed by the 7-digit number for calls within the home numbering plan area. At the time when area code shortages forces the use of the same code for both an area and an office, arrangements will be needed to determine whether the first three digits represent an area code or an office code.

Customer Acceptance

It was felt that a plan that was essentially an extension of the present plan would be more readily accepted by users than a radically new plan. Such a plan would also be most desirable from customer education standpoint.

Description of the Plan

The numbering plan adopted will be implemented in three stages:

1. A period during which area codes of the present type will be employed.

2. A period during which ABO codes may be used to augment present-type area codes.

3. The ultimate stage when 800 area codes of the AXX-type will be available. At this time 792 AXX-type office codes will also be available with ANC (8×10×10 minus the eight A-1-1 type service codes).

Dialing Procedure Prior to Area Code Shortage

Common control areas. Regular (sent-paid station-to-station) foreign area DDD calls will be dialed as at present. Home area DDD calls will be either 7 or 10 digits, depending on the preference of the operating telephone company.

Customer-dialed special toll calls such as person-to-person and collect will require the prefix "0" (zero) which will be followed by seven or ten digits as in the case of regular DDD calls.

For assistance calls, "0" alone will be dialed. Since special toll calls may use the prefix "0", an appropriate circuit will wait where the prefix "0" is used to see if further digits are forthcoming. Service codes will be of the present form, namely A-1-1.

At the option of the operating telephone company, the prefix "1" may be adopted at an early date for regular DDD calls to act as a barrier against reaching toll points in error on local-intended calls.

Step-by-step or mixed areas with rotary dials. For regular DDD calls, the toll office access code "1" followed by seven or ten digits is recommended to simplify dialing.

Customer-dialed special toll calls should use the prefix "0" followed by seven or ten digits.

"0" will still be used for assistance operator calls when customer dialing of special toll calls is inaugurated with the "0" prefix. Existing service codes of the form "11X" will be retained.

Dialing Procedures in Early Stages of Area Code Congestion

When the area code capacity of the present numbering plan is exhausted, unused office codes of the form ABO may be used for area codes. These

can provide additional area codes at the expense of office code capacity which would be correspondingly reduced.

Ultimate Situation

In the mid-1970's additional area code capacity may be needed. The "1" access code for regular DDD calls will then be standard. Area codes will be of the form AXX of which there are 800. There will be a maximum of 792 AXX-type central office codes. It will be desirable and probably essential to adopt all-number calling before office codes of the A1X and A0X type are used.

For special toll calls dialed by customers but still requiring operator assistance such as person-to-person, the prefix "0" will continue to be used.

Assistance operator calls will continue to use "0" alone. No change is contemplated in service codes.

The same procedures will be recommended for common control, step-by-step, and mixed areas. However, no one will be required to adopt all the elements of the proposed plan, particularly with equipment where parts of the plan might not be feasible. Thus, 2- and 3-digit access codes may be used with systems which require them although they are not recommended. A two or three digit access code followed by the prefix "0" for special toll calls may also be used.

Abbreviated home area dialing will be used. Thus home-area toll calls will have the form 1 AXX XXXX or 0 AXX XXXX. It will be necessary to provide a feature to distinguish between eight and 11 digit calls where conflicts exist between area and office codes.

Special barrier codes are not a part of the plan. The access codes "1" and "0" are in themselves barriers against reaching toll points in error, and once they have been adopted their use will be mandatory.

Equipment Modifications Required

All existing telephone switching systems, both local and toll, with the possible exception of step-by-step intertoll equipment, will need to be modified. It is too early to describe the modifications required in detail, but some general observations can be made on the nature of the changes.

All common control local systems must be modified to enable them to do the following:

1. To register the prefix "1" or "0" and to signal the translating equipment which prefix has been received. The prefix will not be sent to the toll office.

2. To check after an initial "0" to see whether more digits are forthcoming. If only "0" is received the call will be routed to the operator.

3. To route calls selectively on the basis of the prefix and the code which follows.

4. To determine whether an 8- or 11-digit call is intended in areas using AHAD.

5. To provide translation capacity for up to 800 area codes and 792 office codes.

6. To determine whether a code is used both as an area code and an office code where AHAD is provided.

7. To block toll calls which are received without a prefix.

The step-by-step local system will need to have special trunks from the "1" and "0" levels. The "1" level trunk will cause an immediate seizure of a trunk to the toll office and a fast seizure of a sender or register at that office. If the second digit is 2 to 9, it and succeeding digits will be repeated to the toll office equipment and stored there. However, if the second digit is a "1," it will be absorbed, the toll office trunk will be immediately released, and the auxiliary selector will accept the third digit and route to a service trunk.

The "0" level trunk will be arranged to distinguish between prefix "0" toll calls such as person-to-person and collect, and "zero" operator calls.

At the toll office some of the important new features are as follows:

1. Additional translation capacity for up to 800 area codes and 792 office codes.

2. Arrangements for determining whether a seven or ten digit number is intended.

3. New trunks for the "0" prefix calls.

Some of the work mentioned has already been started. The simple access code "1" arrangement has been developed for step-by-step and no. 5 crossbar, and will soon be in use in many locations.

The prefix "0" arrangements are also in use in a few locations now arranged for customer dialing of person-to-person toll calls. Many more will use it as they install equipment for customer dialing of calls requiring operator assistance.