

Nationwide Numbering Plan

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In telephone language a numbering plan gives each telephone in a city, a town, or a geographical area an identity or designation different from that given any other telephone in the same area. There is a wide variation in the types of numbering arrangements in use today in the Bell System, and this paper gives the reasons for this diversity, and examples of the various numbering plans now in use. With the introduction of modern toll switching facilities and the extension of toll dialing to nationwide scope, it was realized that an improvement in the method of dialing toll calls to distant cities was essential in order to realize the maximum speed and accuracy inherent in toll dialing. A nationwide numbering plan covering the United States and Canada has been designed. Each of the more than 20,000 central offices in the two countries are to be given a distinctive designation which identifies that particular office. This designation is to consist of a regional or area code and a central office code. The new switching equipment for the key points in the toll network is being designed so that any toll operator, wherever located, will use the same designation or code for reaching a given office. The combination involved in laying out these areas and the composition of the area codes are presented. A total of 152 codes are available of which approximately 90 are assigned to the present numbering plan areas. Ultimately each central office will be given a type of number consisting of an office name and five numerical digits, such as LOfust 4-5678, in which the first two letters of the office name become the two letters of the central office code. The entire program will take a considerable number of years to realize, but is one which must be accomplished in order to achieve the best results in operator toll dialing and the ultimate goal of nationwide customer toll dialing.

In telephone language a numbering plan is exactly what the name implies, a plan or system of giving each telephone in a city, a town or any geographical area an identity or designation which is different from that given every other telephone in this same area. This designation is the

telephone number; it appears in the directory and in most cities on the telephone instrument itself. It is the address of the telephone in the telephone network. Just as it is essential for efficient postal and delivery service to have streets and house numbers clearly marked, it is important for good telephone service that the telephone numbering plan be such that it will be used with convenience and accuracy by the telephone customer.

A telephone number is comprised of two elements, a designation for the central office to which the telephone is connected and a number within the central office which identifies one particular telephone from all others served by that office. If there is only one central office in the city or town, the office designation is frequently omitted. A dial office is designed to serve up to 10,000 numbers with a limitation of four digits. Typical numbers are therefore MAin 2-1234, ADams-2345, 5-6789 and 3456, the office designations being MAin 2, ADams and 5 with the last four digits in all cases representing the number within the central office.

There is a wide variation in the types of numbering arrangements in use today in the Bell System. This diversity arises from the fact that telephone communities vary greatly with respect to the number of telephones served, ranging all the way from New York City with its more than three million telephones and three hundred central offices to small villages and rural communities with perhaps a few score or a few hundred telephones.

In the 1920's when the Bell System embarked upon its program of converting local offices to dial operation each exchange or city was in general an entity unto itself. Customers dialed local calls within their own city but all calls involving a toll or multi-unit charge required handling by operators for timing and ticketing. There was no advantage, therefore, in making a numbering plan for a given city more comprehensive than required to serve the telephones and central offices in that city with a suitable allowance for the expected growth. Thus there were formed a multitude of local dial communities, large and small, within which customers could dial their own calls and connections between these telephone communities were established by operators.

Over the years these basic numbering plans which were originally established for local dialing have in many of the cities proved inadequate to furnish as many office codes as later events have shown are required. This is due to a variety of causes. The station growth in many places has outstripped all expectations and the number of central offices required to serve this unprecedented demand for service consume many more office codes than the original plans provided for.

In many places local service areas were changed so that customers could call into contiguous exchanges at local rates. To enable customers to dial into these nearby places the original numbering plans required expansion to include this increased number of offices. In addition, with the advance in the telephone art many cities introduced equipment for automatic charging on multi-unit and short haul toll calls so that customers could dial such calls directly instead of placing them with an operator for completion. In order to enable customers to dial these calls, it was necessary to expand the original city numbering plans to encompass wider and wider geographical areas.

In expanding the various types of numbering plans to serve a larger number of central offices than were originally anticipated, various expedients were resorted to. In the largest cities having three-letter office codes a numeral was substituted for the third letter thus very materially increasing the code capacity from about 325 to about 500 and making it possible to form a number of codes using the same office name. The name CANal for example, instead of serving but one office may serve a number of offices, CANal 2, CANal 3, CANal 4, etc. In the medium size cities having two-letter codes, expansion meant adding a digit to the code to all or in some cases to only a part of the offices in the city.

The five-digit places were usually expanded by adding a digit to some of the numbers so that some of the telephones had five digits and others six digits in their numbers.

As a result of choosing originally a numbering plan which at the time seemed adequate and most suitable for the city involved and in many cases being forced to expand to meet changing needs, we now have in the Bell System a considerable variety of different numbering plans. These are given in Table I. The numbering plans given are all adequate to serve the present local dialing needs for the cities in which they appear.

Having reviewed the numbering plan situation as it exists today in the various cities and towns, let us turn to the problem of handling toll calls. Under ringdown operation there is an operator at the outward toll center where the call originates and another operator at the terminating or inward toll center. On built-up toll connections there are additional operators at each intermediate toll switching point. The inward toll operators, who are familiar with the numbering plans in the offices served by their particular toll center, can be relied upon to connect to the desired station even though there is uncertainty on the part of the calling customer or the outward toll operator regarding the precise pronunciation or spelling of the name of the called office or the particular form of numbering system used at the called city.

Under operator toll dialing the inward operator is replaced by dial switching equipment under the control of the outward operator; hence the outward operator has no one to rely upon but herself in completing a toll connection to a distant city. With the present method the operator dials a code for each circuit group in the connection followed by the number of the called party which may consist of any number of digits from three to seven. The operator must refer to her position bulletin or to a routing operator for the correct circuit group codes unless she happens to remember them. Where the office to be reached has central office names, the operator must rely on routing information to determine how many letters of the name are to be dialed. The great variation in the number of digits to be dialed on different calls is a source of some difficulty and confusion to the operators.

The present system of operator toll dialing by which operators use codes depending upon the routes to reach a desired destination, is a great improvement over the old manual handling methods. However, with the introduction of more modern toll switching facilities and the nationwide extension of toll dialing, it was realized that an improvement in the methods for dialing toll calls to distant cities was essential in order to realize the maximum speed and accuracy inherent in toll dialing.

These handicaps in the present toll dialing methods are to be overcome by establishing a nationwide numbering plan covering the United States and Canada by which each of the more than 20,000 central offices in the two countries is to be given a distinctive designation which identifies that particular office and that office only. This designation is to consist of

TABLE I—DIFFERENT TYPES OF NUMBERING PLANS

Place	Directory Listing	Customer Dials	Ordinarily Referred to as
Philadelphia, Pa. Los Angeles, Cal.	LOcust 4-5678 PARKway 2345 and REpublic 2-3456	LO 4-5678 PA 2345 and RE 2-3456	Two-five Combined two-four and two-five
Indianapolis, Ind. El Paso, Texas	MArket 6789 PRospect 2-3456 and 5-5678	MA 6789 PR 2-3456 and 5-5678	Two-four Combined two-five and five digit
San Diego, Cal.	Franklin 9-2345 Franklin 6789	F 9-2345 F 6789	One letter, four and five digit
Des Moines, Iowa	4-1234 and 62-2345	4-1234 and 62- 2345	Combined five and six digit
Binghamton, N. Y. Manchester, Conn.	2-5678 5678 and 2-2345	2-5678 5678 and 2-2345	Five digit Combined four and five digit
Winchester, Va. Ayer, Mass.	3456 629 and 2345	3456 629 and 2345	Four digit Combined three and four digit
Jamesport, N. Y.	325	325	Three digit

two elements, a regional or area code and a central office code. Any outward toll operator, wherever located, will use that same designation in reaching that office through the dial toll switching network.

In a sense, all of the thousands of offices involved are to be treated as though they were contained in one huge multi-office city. Toll operators will use the area code and the office code in reaching an office situated outside her own numbering plan area, while on calls to points within her own numbering plan area she will dial only the number as listed for toll in the directory. In principle the method employed is to divide the two countries geographically into numbering plan areas and to give each of these areas a distinctive code. Refer to Fig. 1. Within each of these numbering plan areas each office will have a code unlike that of any other office in the same numbering plan area and also unlike any area code. Hence for toll dialing purposes each office will have an area code and central office code which will form a combination unlike that of any other central office in the two countries.

In this geographical division into numbering plan areas, border lines between states and between Canadian provinces have generally been used as numbering area boundaries. Since about 500 central offices are the maximum number which can be served in a numbering plan area, it is necessary to divide the larger and more populous states and provinces into two or more areas making, of course, due allowance for growth. New York state with the largest number of central offices is divided into six numbering plan areas; Pennsylvania, Illinois, Texas and California have four areas each. Other divided states have three or two areas depending upon the number of offices to be served. Approximately 90 areas are being provided, with 14 states and two provinces served by two or more numbering plan areas, the remaining states and provinces by one area each.

In fixing the intrastate numbering plan area boundaries of subdivided states, among other considerations effort was made to avoid cutting across heavy toll traffic routes in order to have as much of the toll traffic as possible terminating in the area in which it originated. The advantage of arranging the numbering plan areas in this manner is readily apparent since on this traffic which does not pass an area boundary the area code is not required.

Let us now consider the composition of the area codes. As indicated previously they must be of a type which will enable the switching equipment to distinguish them from the codes of central offices.

On the telephone dial plate letters are assigned only to the dial positions 2 to 9, inclusive (on some dial plates a Z appears on the 0 position

but the Z is never used in a central office code), hence any office code will always avoid a 1 or a 0 in the first two places. The digits 1 and 0 can therefore be used in area codes to distinguish these from office codes. It is not practical to use them as initial digits of area codes since customers dial 0 to reach operators and the local dial equipment is arranged to ignore an initial 1 for technical reasons. A 1 or 0 in the second place, however, can be employed in an area code without conflicting with any central office codes or interfering with any existing practices. Accordingly the area codes will consist of three digits with either a 1 or a 0 as the middle digit, 516, 201, etc. A few codes of this type are now in use, leaving a practical total of 152 of these area codes available as compared to approximately 90 assigned to our present numbering plan areas. This will provide a comfortable spare for additional future numbering plan areas or possibly for reaching overseas points which may later be incorporated into the toll dialing network.

As shown in Fig. 1, states and provinces such as Montana or Alberta which are contained in a single numbering plan area will have area codes with a 0 as the middle digit to distinguish them from areas in divided states such as Texas where the middle digit will be a 1. This is to enable toll operators to differentiate between the two classifications of areas. On calls to single area states the operators will always know that every call to the state in question uses the one area code, whereas on calls to subdivided states additional information will be required to determine which of the several area codes should be employed to reach the particular destination. It is proposed to show on the operator position bulletin the codes of all single area states and the codes of all frequently called cities in multi-area states. The area codes of the less frequently called places in the multi-area will be obtained from a routing operator.

Within each numbering plan area each of the 500 or fewer offices are to be given a three-digit office code which will be different from that of any other office code in that same area. Ultimately each central office will be given a 2-5 type of number consisting of an office name and five numerical digits, such as LOcust 4-5678, illustrated for Philadelphia. In the larger cities customers will dial seven digits, LO 4-5678, on local calls to numbers in the same exchange. In many of the smaller places the customers on local calls will dial only the numerical digits, the office name being employed for toll dialing purposes only.

Considering the thousands of central offices which now have numbers other than the 2-5 type and the fact that to change existing numbering systems is a difficult and often costly procedure, it will be a number of years before this ultimate objective is realized. As a practical measure,

therefore, it will be necessary during this interim period, before the central office names with the 2-5 type of number are established everywhere, to employ for operator toll dialing office codes which in many cases may not be derived from the customers' telephone number.

In dialing to a combined 2-4 and 2-5 city, for example Los Angeles, the three-digit office code for the Parkway office which has six digits in the local number, will be PAR, whereas to reach the Republic 2 office having seven digits in the local number, the office code will be RE2. To call a telephone in Winchester, Va., with only four digits in the local number, the operator will use a code consisting of numerical digits only, such as 294 which, of course, must be different from every other office code in this numbering plan area. To secure the particular office code to be used in reaching an office where the called number does not furnish complete information, the toll operator must refer to a position bulletin or the route operator. This reference work, of course, takes time and therefore imposes a delay in completing the call.

In addition to giving a distinctive three-digit code to each office within each numbering plan area, each toll center will also be given a three-digit code to enable outward operators to reach inward information, and delayed call operators at toll centers in distant cities. Calls to these operators will be routed in the same manner as calls to customers except that the operator codes will be used instead of a station number and a toll center code in place of a central office code.

The central office names now in use in the various cities in the System were chosen, generally speaking, on the basis of their suitability for customer dialing within the city itself. Many of these names are unfamiliar words to operators and customers in distant cities and the use of these names contributes materially to the operator dialing errors. This situation is gradually being corrected by using for new offices, names from a System approved list and replacing existing names which experience has shown to be particularly troublesome by names from this list.

While numbering plans are important in operator toll dialing, they play an even more essential part in the dialing of toll calls by customers. Operators can be trained to adapt their dialing procedures to the type of local numbering system encountered in the called city even though more time is consumed and more errors result than would be the case if all telephone numbers were of a uniform type. Customers, however, could not be expected to follow any plan which requires a variety of different procedures to be used in reaching different cities. Only a numbering system which is readily understandable and which customers find

convenient to use and one which they can use with a very high degree of accuracy will suffice. The need for accuracy is readily apparent since with the customer's telephone being given access to the intertoll network without the intervention of an operator, a call which is misdialed can be routed to a telephone thousands of miles from the desired destination.

At present customer dialing of toll and multi-unit calls is for the most part confined to situations where the call can be completed by the use of the number as listed in the directory without any additional digits being dialed. In a few cases as from Camden, N. J. to Philadelphia and certain offices in Northern New Jersey to New York City, the code 11 is prefixed to the listed number. In the case of the current trial of customer toll dialing at Englewood, N. J., the customers are using area codes such as 415 for Oakland, California, 312 for Chicago, etc., dialing only into those cities which now have the 2-5 type of numbering.

From the Englewood experience it can be confidently predicted that this form of dialing, i.e., an area code followed by a telephone number consisting of a uniform number of digits, is one that customers will use with a reasonable degree of convenience and accuracy. The problem therefore to meet the requirements for nationwide customer toll dialing, is to establish universally for all central offices regardless of size and location a uniform pattern of numbering for toll purposes. The only form of number completely filling the needs is the 2-5 system, which is that used in the largest cities today.

Accordingly, in order to implement the program for customer dialing of toll calls on a nationwide basis, it will be necessary to place all telephone numbers on a 2-5 basis with the code of each office different from that of every other office in the same numbering plan area. Thus each of the 50,000,000 telephones in the United States and Canada will have, for toll dialing purposes, a distinct identity consisting of ten digits; a three-digit area code, an office code of two letters of an office name and a numeral, and four digits of the station number within the office. Typical numbers for toll dialing would therefore be 601-CA3-4567 or 317-MA7-6789. As with operator toll dialing, on a toll call which terminates in the same numbering plan area in which it originates, the area code will be omitted and the office code and station number—a total of seven digits will be used.

With this universal 2-5 type of number, local calls in and about the larger and medium sized exchanges will be completed by dialing the entire seven-digit number. For many of the smaller places in the more isolated sections, 5-digit or 4-digit dialing will frequently be employed where this number of digits will be adequate for all of the telephones

in the customers' local dialing area. For these offices with five or four-digit local dialing and for offices in the larger places served by certain types of dial equipment, as they are arranged today, it will be necessary to prefix the dialing of toll calls by a transfer or directing code to permit the customer getting from the local office into the toll network.

Independent of the advantages of a universal 2-5 numbering plan for nationwide operator and customer toll dialing, the Bell System has made considerable progress in this direction over the past several years. New York and Northern New Jersey adopted 2-5 numbering in 1930 in order to take advantage of the flexibility of office code assignments and the large code capacity which this type of local numbering provides. Since World War II many cities and their environs such as Chicago, Boston, Philadelphia, San Francisco, Oakland, Pittsburgh, Milwaukee, Providence and a number of smaller cities have followed suit. Presently about 12 million telephones are in areas which have 2-5 numbering exclusively in addition to perhaps two million telephones with 2-5 numbers in mixed 2-4 and 2-5 areas. Another five million telephones are already planned for conversion to 2-5 numbers within the next several years.

The entire program will take many years to realize but it is one which must be accomplished in order to achieve the best results in operator toll dialing and make it possible for a customer at any telephone in the United States and Canada to reach a telephone anywhere in the two countries by dialing without the assistance of an operator.