MiVoice MX-ONE

Numbering - Operational Directions

Release 7.3 SP2

May 12, 2021

Notice

Trademarks

Contents

General

Scope

These operational directions give a concise, summarized overview description of the O&M handling of numbering and numbering plans. The same, and more detailed, information can be found in the different operational directions in the References clause.

Originally the handling of numbers has been no problem, quite small and less complex systems, less functionality, no or limited connection to private networks and only a few number types to take care of. But today the systems have grown rapidly with complex network solutions, many new standards to handle and a lot of new functionality. This has resulted in, that for each new release, the handling of numbers has become more and more complex.

Glossary

General

For a complete list of abbreviations and glossary, see the description for *Acronyms, Abbreviations and Glossary*.

Number Storage and Analysis

Before looking into the different numbering plans, network configurations and number conversions, a brief look at the basics of number handling will be made. The different analysis types and something about how and why digits are stored in the system will be explained. In the end it is how numbers are stored and analyzed in the MX-ONE Service Node that sets the boundaries and limitations for the system.

Number Storage

Numbers can be defined as either a series, for example extension numbers 1500-1800, or as a single number, for example a common operator access code 09. Numbers with different number type are stored in separate analyses data records.

Overlapping numbers or subnumber series cannot be defined, except for common operator DID numbers, and that is possible because there are two separated link trees.

All numbers initiated with the `number_initiate` command are stored in analyses data records, and to find matching records at number analysis linked block data records are used, pointing out the wanted number or number series.

Feature codes belonging to certain application systems are also stored in the NA link tree, (* and # have their own block data records), therefore the same rules are applicable for them too.

Analyzing Dialed Digits

A number analysis is carried out for each digit in order to identify the type of the dialed number. Depending on the system line user type, the addressing digits are either received one by one (for example, at manual dialing) or in a group (for example, when a name selection button on a telephone is used).

There are different types of analysis to decide whether a number is correct or not. These types correspond to different number types and are stored in different link tree structures.

DID-analysis (Direct In-Dialing)

If the originating party is an incoming DID trunk, the first analysis step is the DID-analysis. This analysis is used to determine whether the dialed number is a DID-number to an operator group or not.

If the dialed number is defined, the calling process proceeds with traffic distribution, otherwise the analysis continues with internal analysis.

Internal Analysis

The purpose of internal analysis is to analyze the subsequent calling process and decide whether further analysis is necessary. The result of the internal analysis is presented as *Number Types*.

External Analysis

If a number being analyzed is found to be an external number, the number is forwarded to external analysis, private network routing analysis (PNR) or least cost routing analysis (LCR), where the dialed number can be modified into a new called number for routing in the network. In LCR, it is also possible to modify the dialed number into a new dialed number. In PNR, individual number translation in two steps is possible.

Parameter Analysis

Parameter analysis is used to determine whether the parameters in the procedures are of correct format (number of digits), of correct number type (for example, extension number) and so on. The extent of this analysis depends on the feature.

Parameter analysis is also used to determine when a * or # character is received in order to be able to separate the parameters and to be able to recognize the end of the procedure.

Definitions

Number Types

As a way of separating numbers for extensions, operators and other nodes in the network, a set of number types has been defined in the system. The number type distinguishes the various complete and shortened form of numbers, and it is separated from the number itself.

The number type is stated in the parameter `-numbertype` when initiating, removing, or printing a number or number series. For NA commands, see the command description for *NUMBER ANALYSIS, NA*.

NOTE: The internal number types used within the MX-ONE Service Node (for example, extension number, operator numbers, and so on), are not the same Type Of Numbers (TONs) as sent to the private or public network. Those type of numbers are explained below.

Number Handling

A basic feature that is almost always available (except for manual external lines) is conveyance of a called number over the external line.

Some signaling systems also support conveyance of the calling and connected party identity over the intervening network. The conveyed calling or connected number is commonly used for display purposes at the other party end. See the following Figure 2 for more information about the possibilities of different signaling systems and configurations.

Called Number

- The called number that is sent forward in the network. Used for routing. Not necessarily the dialed number. Independent of signaling system.

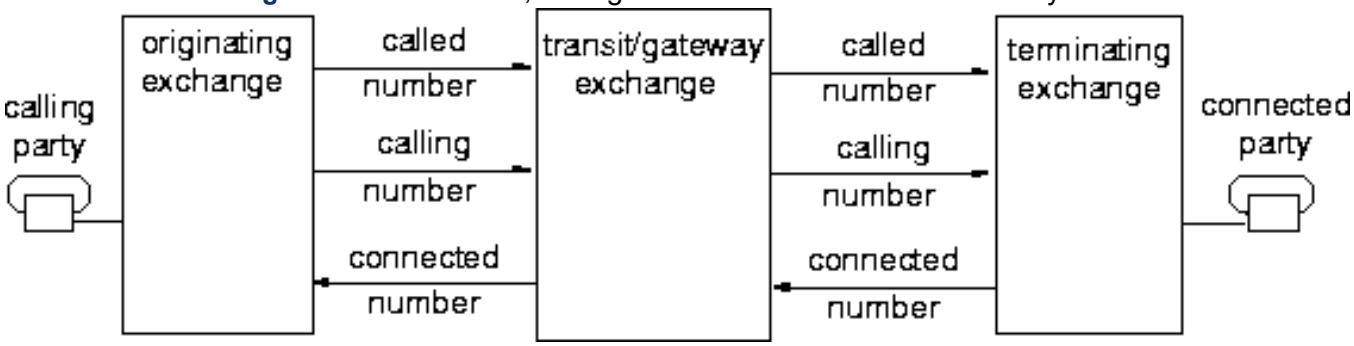
Calling number

- The A-party identity. Commonly used for metering and display purposes at the B-party. Both a private and a public calling number are composed.

Connected number

- Identity of the connected B-party. The number which is sent backward in the network from the terminating node. Not necessarily the same number as the called number.

Figure 1.1: How called, calling and connected number is conveyed in a network



The calling and connected number can be represented as a public or private number. In some cases both the public and the private number are composed and sent to the inter-working part. In a VPN, for example, where the public number is conveyed as the ISDN standard prescribes to the public ISDN, and the private number is conveyed end-to-end between the MX-ONE Service Nodes in a user-user information element.

Depending on the signaling system, a various amount of information relating to the number can be conveyed together with the number. Normally the type of number (TON) and presentation indicators are conveyed with the number. MX-ONE supports public ISDN and QSIG.

Figure 1.2: Different signaling system support for conveyance of number and TON[1]

Connection with:	to:		Calling number		Connected number		Called number	Calling TON		Connected TON		Called TON
			public	private	public	private		public	private	public	private	
CCS	Public network	ISDN	standard	-	standard	-	standard	0-4	-	0-4	-	0-4
		DASS	standard	-	-	-	standard	-	-	-	-	-
		VPN 1 *	standard	UUI *	standard	UUI *	standard	0-4	5-7, UUI *	0-4	5-7, UUI *	0-4
	Private network	QSIG, 1) to public destination	standard	UUI *	standard	UUI *	standard	0-4	5-7, UUI *	0-4	5-7, UUI *	0-4
		QSIG, 2) to private destination ASB 501 04 to ASB 501 04	standard	UUI *	standard	UUI *	standard	0-4,	5-7 UUI *	0-4,	5-7 UUI *	5-7
		QSIG, 2) to private destination ASB 501 04 to other manufacturers	-	standard	-	standard	standard	-	5-7	-	5-7	5-7
		DPNSS APNSS	NSI	standard	NSI	standard	standard	0-4, NSI	5-7, NSI	0-4, NSI	5-7, NSI	-
CAS	Public network	MFC	accord. to protocol	-	-	-	accord. to protocol	-	-	-	-	-
		decadic DTMF	-	-	-	-	standard	-	-	-	-	-
	Private network	MFC	-	accord. to protocol	-	-	accord. to protocol	-	-	-	-	-
		decadic DTMF	-	-	-	-	standard	-	-	-	-	-

TON - Type of Number

The Type of Number (TON) is additional information that in some signaling systems can be sent together with a number to, or over a public or private network.

1. *) Requires a route that supports conveyance of UUI. Two settings are necessary
- UUI-support for a route is set in parameter VARC for the route (incommand RODAI)
- UUI-support for a destination is set in the ADC parameter (incommand RODDI)

1) A call over a QSIG route to a public destination is controlled by the setting for Called TON to 0-4 (in the ADC parameter) for the destination (in command RODDI).

2) A call over a QSIG route to a private destination is controlled by the setting for Called TON to 5-7 (in the ADC parameter) for the destination (command RODDI).

UUI A way to convey proprietary messages between nodes with the ISDN signalingsystem.

NSI A way to convey proprietary messages between nodes with DPNSS or APNSS signaling systems. UUI are used by the MX-ONE Service Nodes to convey messages over the intervening ISDN-network between MX-ONE Service Nodes or ASB 501 systems to enable MX-ONE Service Node-proprietary features.

The TON is always affiliated to either a called, calling, or connected number. It is a way to categorize the level of the number in a network, for example, as international, national or local. This categorization is always related to from where in the network the number is seen.

The MX-ONE™ system handles 5 types of public numbers, TON = 0-4, and 3 types of private numbers, TON = 5-7. TON is stated for both the calling and for the called number. The TON for calling or connected number is actually two TONs, one is affiliated to the public number and one is affiliated to the private number.

- TON for called number 0-7
- TON for calling number
  - TON for public calling number 0-4
  - TON for private calling number 5-7
- TON for connected number
  - TON for public connected number 0-4
  - TON for private connected number 5-7

The TON for called number is mainly used for not having to send the national and international prefix to the public exchange. Instead, the TON for the called number (sent together with the called number) is set to international or national. The public exchange will know from the TON instead of from the national or international prefix that it is a national or international type of number.

The TON for the called number is re-set in every transit exchange as the call passes exchanges on its way to the destination. This means that the setting of this TON only have to consider the situation in the closest following exchange.

The TONs for calling number (public and private) is used to control the composing of a complete calling or connected number (public and private) to send to the inter-working exchange or public network. These TONs are first used to compose complete calling numbers (public and private) to send to the terminating exchange. After this, they are sent together with the calling number through the network, and in the terminating exchange they are used to control the composing of the complete connected numbers (public and private) to send back to the originating exchange. Lastly, these TONs are sent back as TONs for connected number with the connected numbers.

In an hierarchic numbering plan, the TON for calling number is mandatory information. The proprietary TON used by the includes both Type of number and Numbering Plan Identifier (NPI) as specified in the ISDN standards. The TON used by the MX-ONE Service Node is a subset of the possible settings in ISDN. When sent to an ISDN the TON is transformed into a proper ISDN TON and NPI. See Figure 2 for more information.

NOTE: The handling of NPI unknown in ASP113 is controlled by an O&M parameter (TL60, VARC). The default behavior is for a received number with NPI unknown to be set as ASP113's TON "unknown public".

Number Structure

The definitions below are to be used consistently in the O&M documentation.

Figure 1.3: Local public (Type of number = 4)

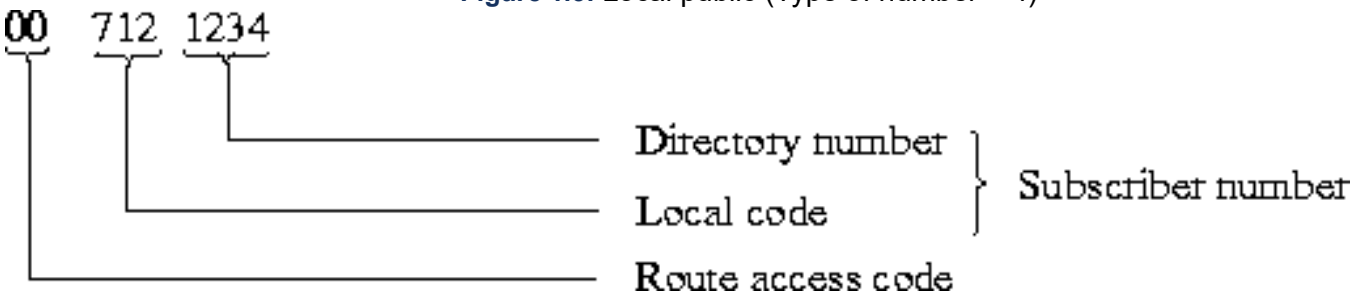


Figure 1.4: National (Type of number = 2)

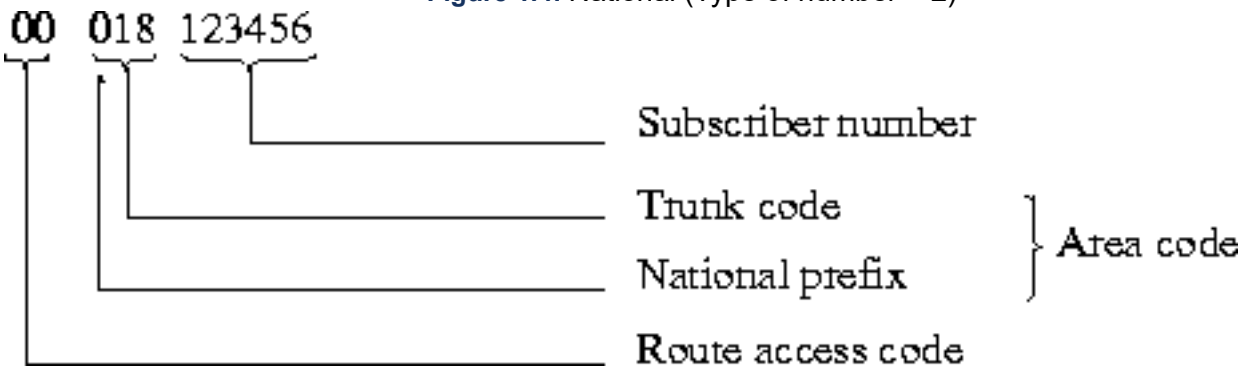


Figure 1.5: International (Type of number = 1)

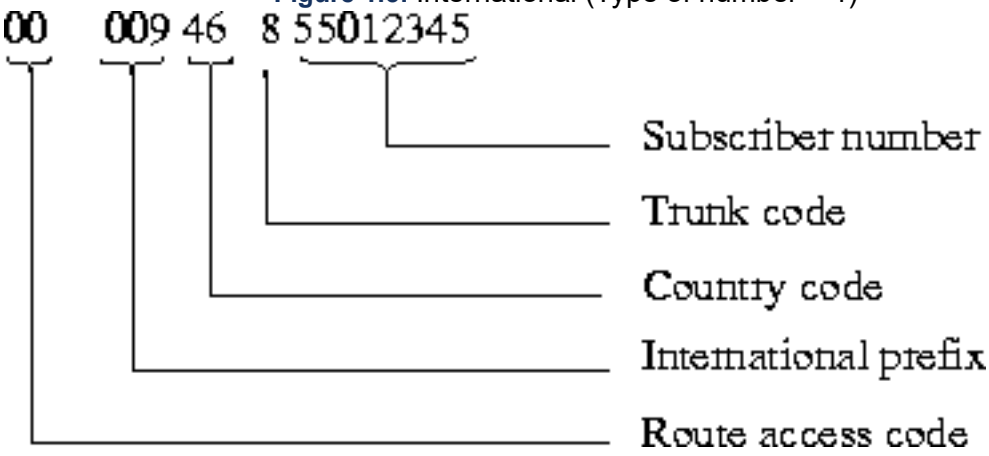


Figure 1.6: Local private (Type of number = 6)

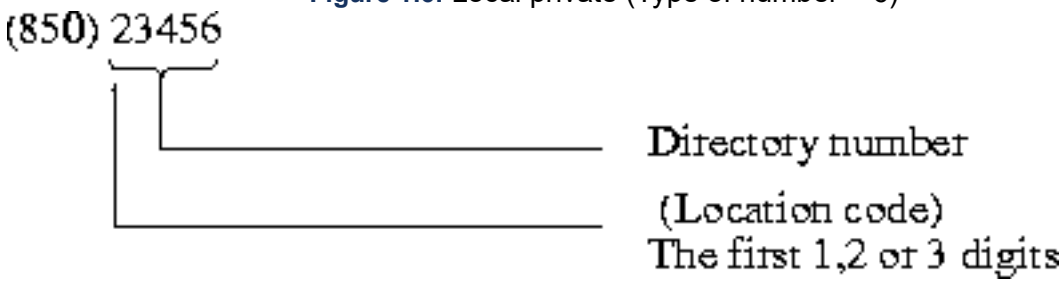


Figure 1.7: Level1 Regional (Type of number = 7)

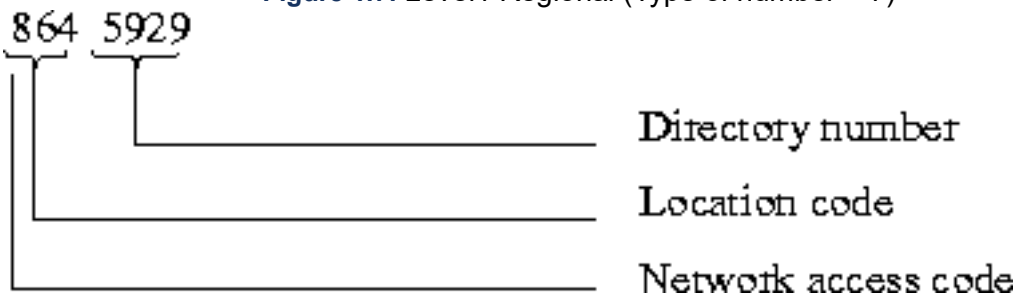
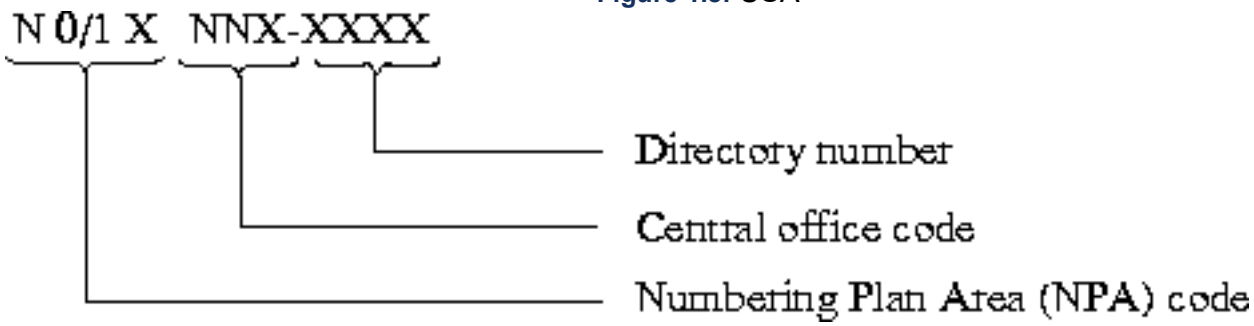


Figure 1.8: USA

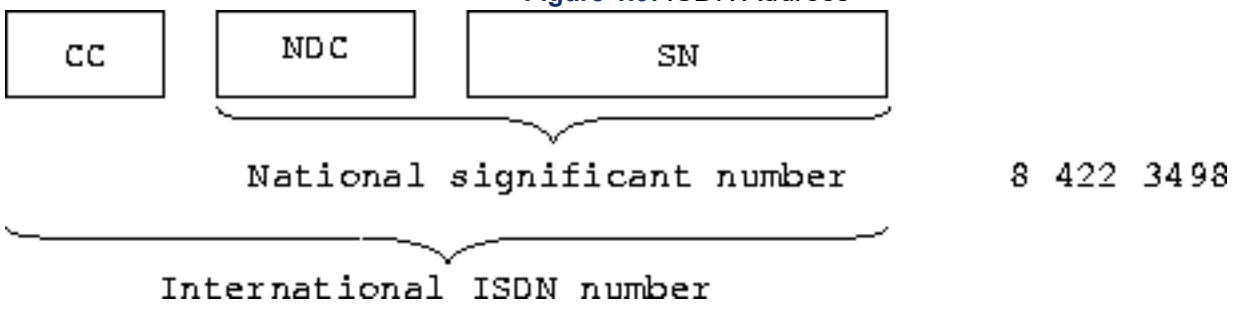


N: Digits from 2 through 9

X: Digits from 0 through 9

0/1: The digit 0 or 1

Figure 1.9: ISDN Address



CC: Country code

NDC: National destination code

SN: Subscriber number

Numbering Plans

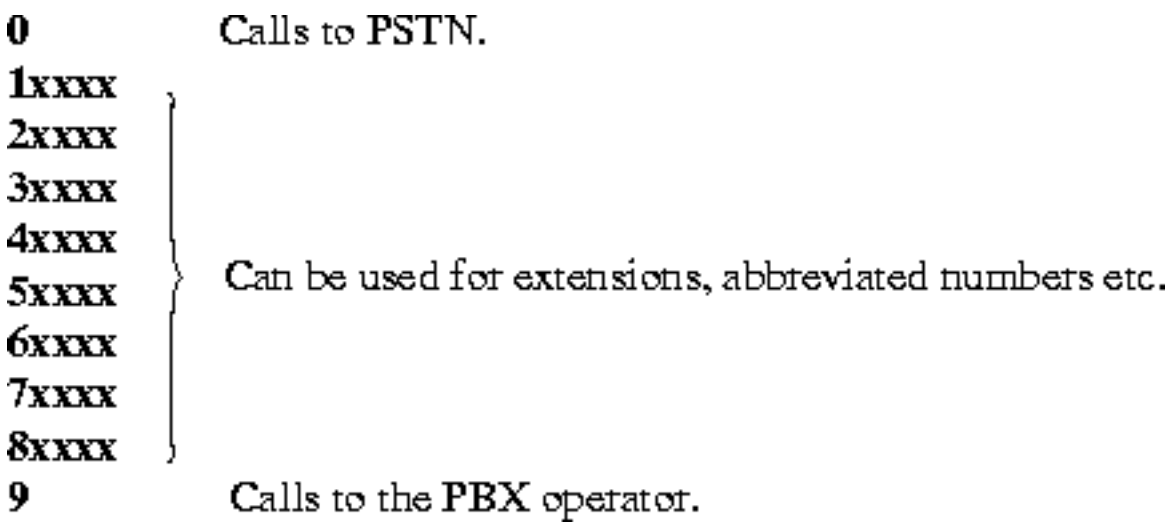
For more information, see 5.3 Descriptions of initiation of different numbering plans on page 23.

Arrangements of a MX-ONE Service Node Internal Numbering Plan

Depending on application, customer, PTT, country, and so on, the use of the first digit is different. This will also affect the numbering plan.

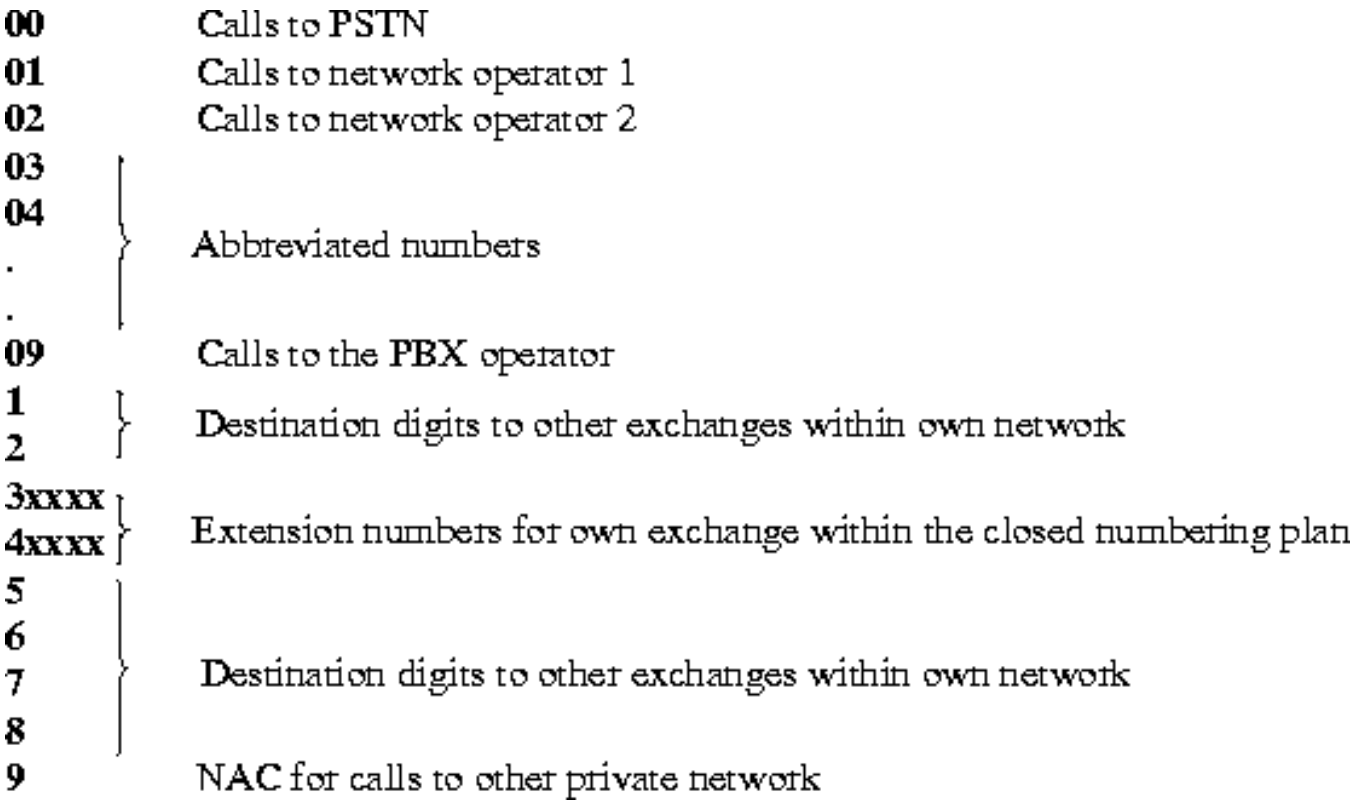
Example 1

The MX-ONE Service Node is only connected to the PSTN. Notice, how the 1:st digit is used.



Example 2

The MX-ONE Service Node is a member in a private network, and connected to two network operators.



Open Numbering Plan, Location Code Based Numbering Plan (Uniform Numbering Plan)

This type of numbering plan is also called **variable length numbering scheme**.

An open numbering plan is where each location (exchange) in the private network needs a unique identifier, a location code, since different exchanges in the network can have extensions with identical direc-

tory numbers. The location code is necessary in order to be able to distinguish two extensions with identical directory numbers but in different exchanges.

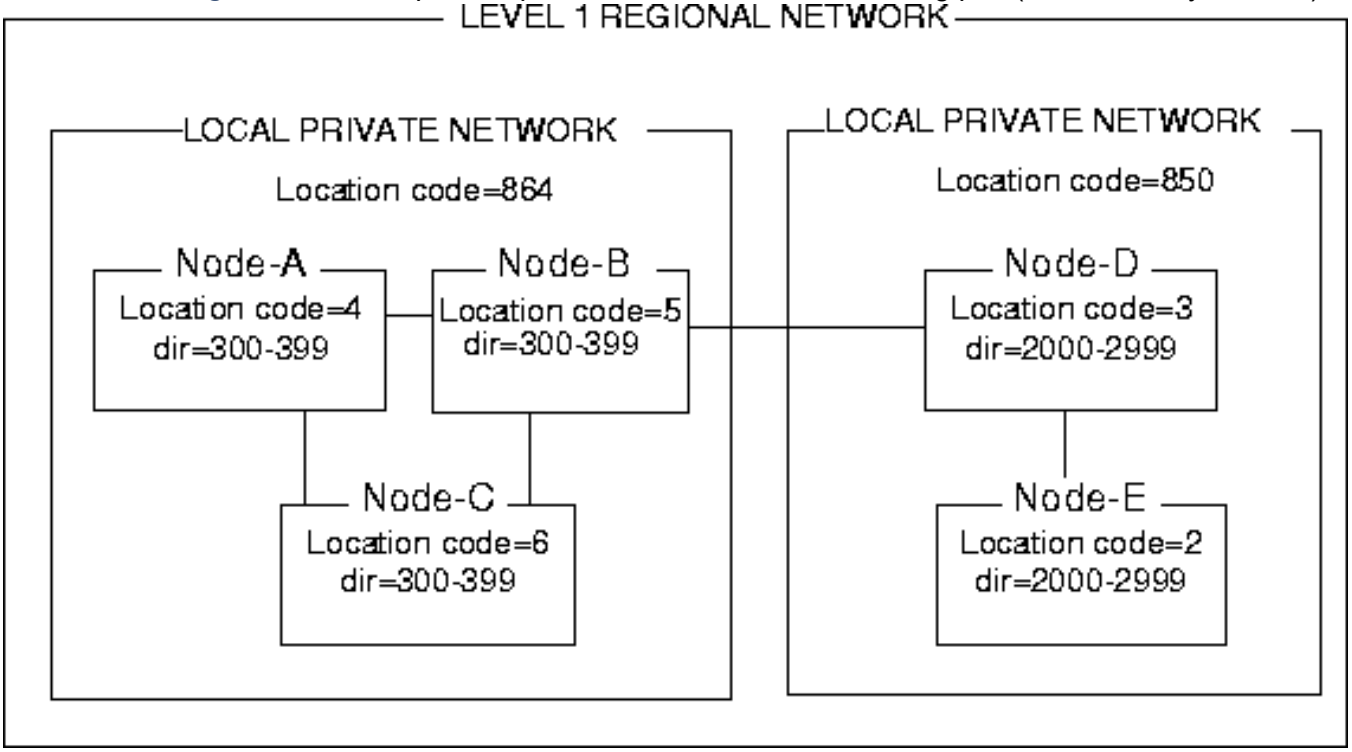
Hierarchic numbering plan

If it is possible to convey TON with the calling, called, or connected numbers within the network, it is possible to divide the numbering plan into different levels.

There are 2 levels:

- Level 1 Regional
- Local private

Figure 1.10: Example of a private hierarchic built numbering plan(dir = directory number)



Closed Numbering Plan (Coordinated Numbering Plan)

This type of numbering plan is also called **fixed length numbering scheme**.

A closed numbering plan is used in a private network where there is no conflict between the first 1, 2 or 3 digits in the directory number series. This means that it is not necessary to use a unique identifier (location code) as for an open numbering plan. Any extension in the network is reached by dialing the directory number of the extension, irrespective of in which exchange the calling party is situated.

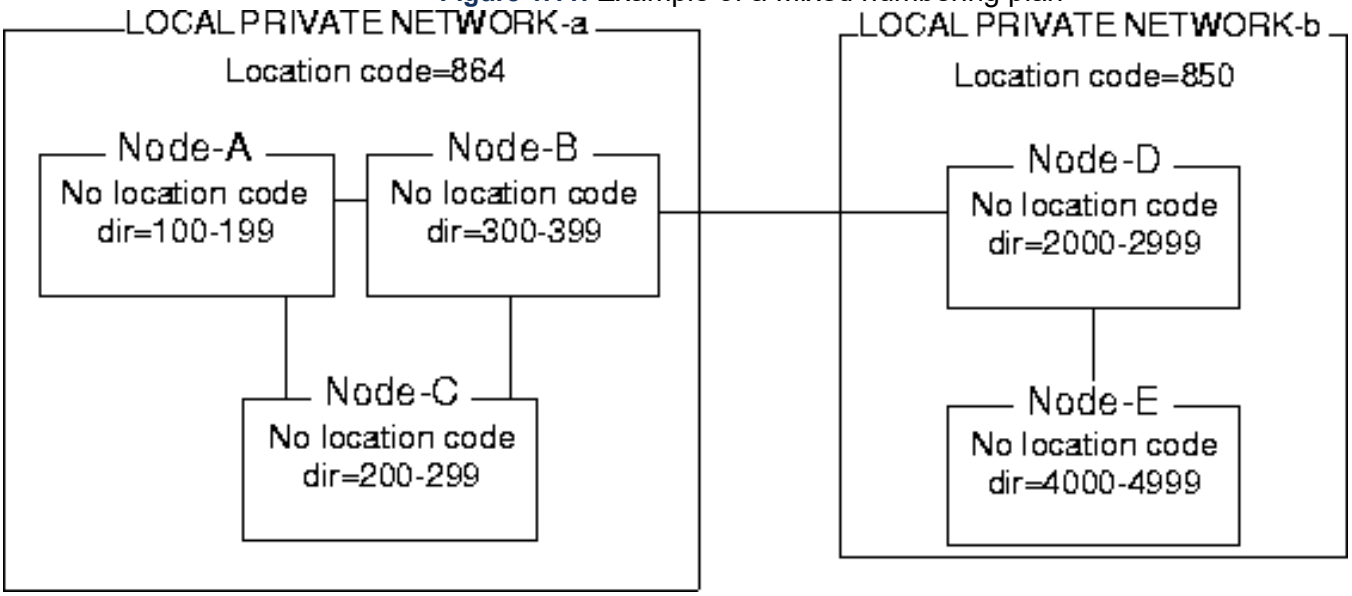
Common Corporate Numbering Plan

An application where the Routing and Number conversion features may be necessary is the realization of a Common Corporate Numbering Plan. Such a number plan has the characteristic that all corporate extensions are uniquely identified and can be reached from any corporate location by dialing of a specific corporate directory number. The exchanges may be connected via tie line, PSTN and/or other networks, in any configuration. The Routing and Number conversion features are used to modify the called or calling number when routing the call via PSTN and other networks.

Mixed Numbering Plan

A mix of open numbering plan and closed numbering plan in the same network is called mixed numbering plan. Typically, the network segment covered by one transit exchange and its dependent exchanges may be initiated as a closed numbering plan. This network segment is then treated as one node in an open numbering plan covering the total network.

Figure 1.11: Example of a Mixed numbering plan



Local private network-a uses a closed numbering plan.

Local private network-b uses a closed numbering plan.

These two networks with closed numbering plans are treated as two nodes in an open numbering plan, that is, together they form a mixed numbering plan.

Arrangements of a MX-ONE Service Node Internal Numbering Plan

Depending on application, customer, PTT, country, and so on, the use of the first digit is different. This will also affect the numbering plan.

Example 1

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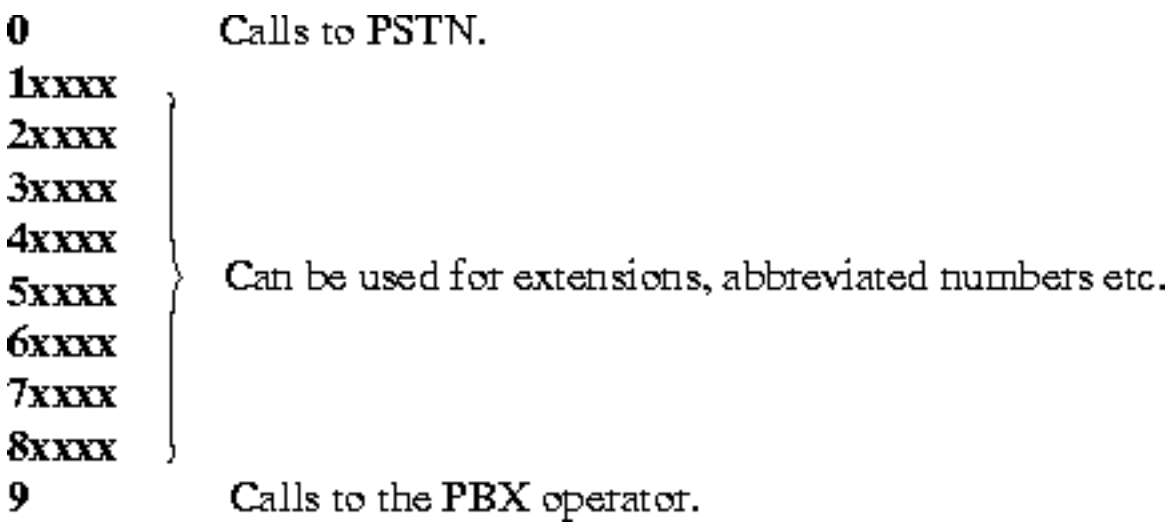

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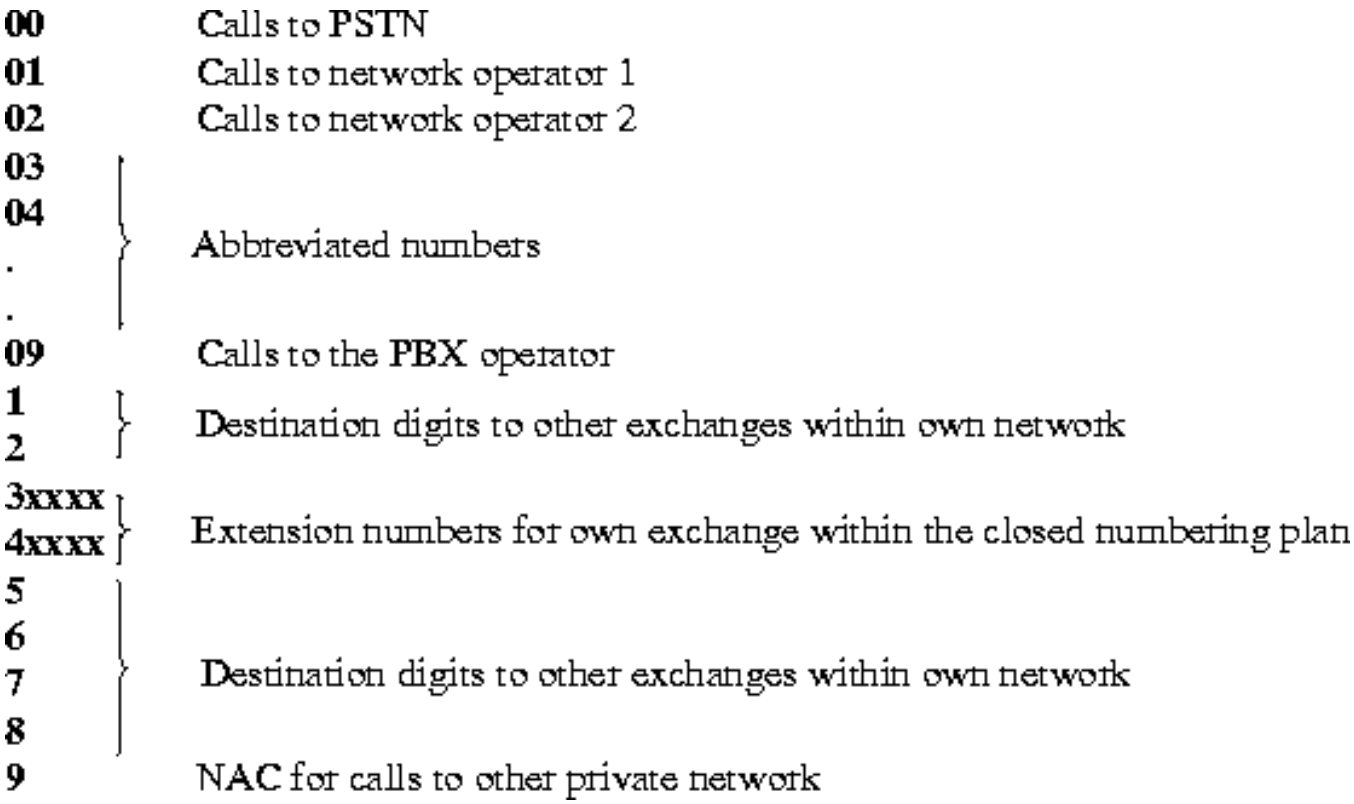

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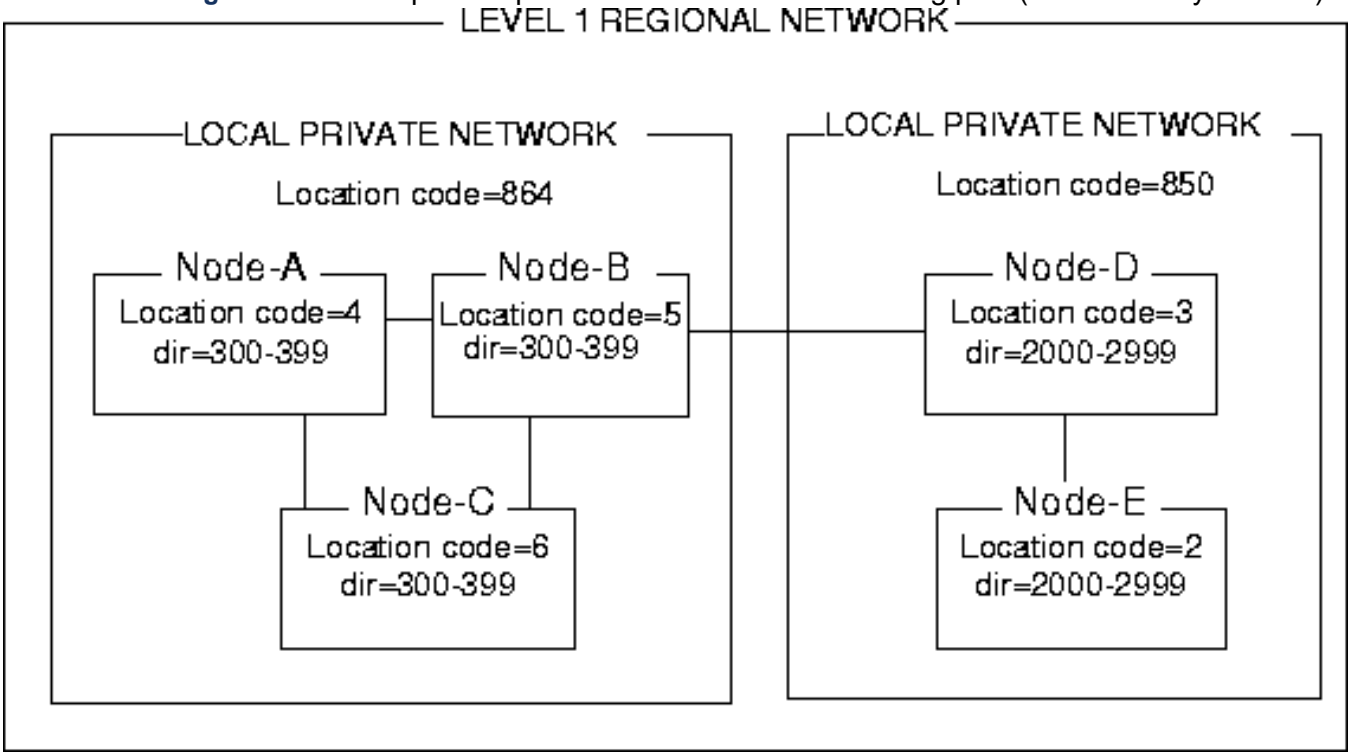

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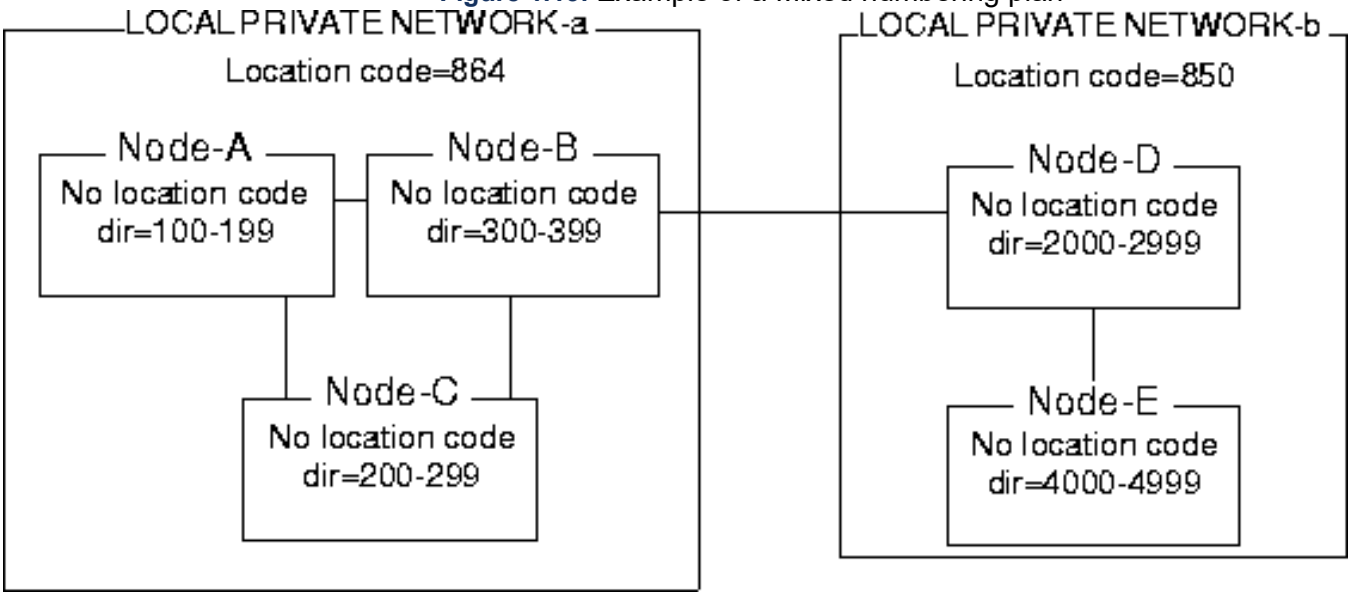

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Number Conversion

Number conversion shall be used as a last resort if nothing else works, in order to get the number handling to work. For example to coordinate private and public numbering plans, without having to make major changes in an existing numbering plan. The typical use of this feature is to enable a common corporate numbering plan in cases where conflicting DID-numbers are received from the public network.

With the Number Conversion feature a calling, called or connected number sent or received from the public ISDN network, or from an ECMA Q-SIG network, can be modified (for example, remove prefixes, country codes or area codes, or international, national or local codes), in order to present a correct number to the parties involved.

It is also possible to modify sent or received TONs and bearer capability with this feature.

NOTE: If net services are to work properly, number conversion shall not be used for calls within the private network. Use it at your own risk.

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Prerequisites

-

Aids

I/O terminal.

Execution

NOTE: *The examples below only show the parameters relevant to the example. Normally, more parameters have to be stated to be able to execute the command.*

Internal Number Handling

The command `number_initiate` is used for controlling called or connected numbers for internal calls.

Extension Directory Number Initiation

Initiate internal number type for extensions, for example, DTS, ATS, and generic extension. ***number_initiate -numbertype ex -number...***.

Operator Number Initiation

Initiate internal number type for operators, OPI.

Direct in dialing common operator number.***number_initiate -numbertype od-number...***

Common operator number. ***number_initiate -numbertype oc -number...***

Individual operator number. ***number_initiate -numbertype oi -number...***

Remote Extension Directory Number Initiation

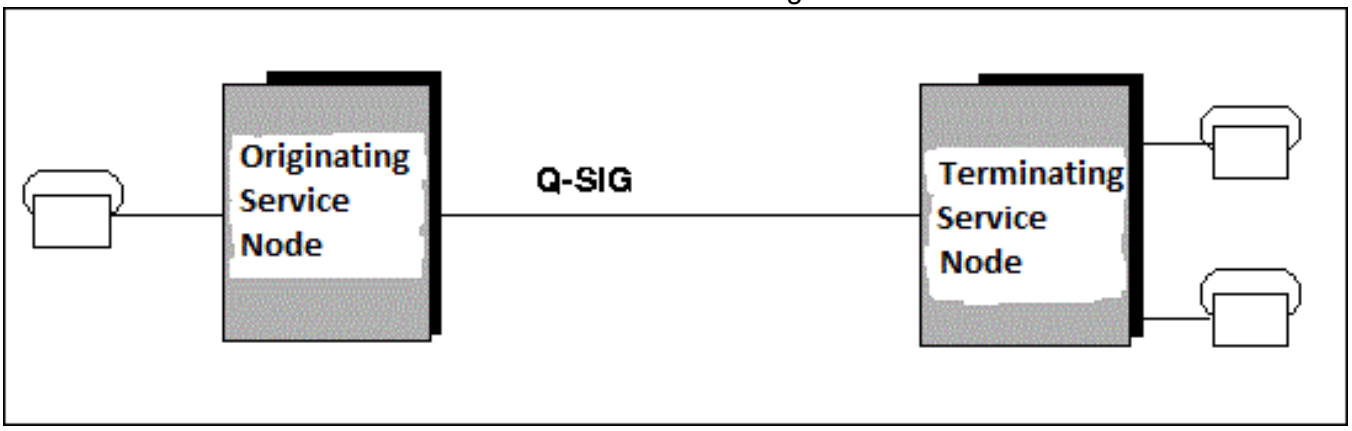
Initiate internal number type for remote extensions, if A-number is available.***number_initiate -numbertype r1 -number...***

or, if no A-number is available for the remote extension: ***number_initiate -numbertype r2 -number..***

Calling, Called and Connected Number Handling

The examples mentioned below all depend on if the signaling system supports calling, called, and connected number handling. A signaling system like ISDN is required, otherwise there is no support for the feature.

Figure 1.14: Example of a configuration that supports calling, called and connected number handling



NOTE: For some markets the called party shall also contain the CID as additional digits.

Calling Party Number

The calling party number (A-party) can be conveyed to the called party if the intermediate **signaling system supports** this. The calling party number consists of the complete calling number (A-party) (in some cases, with SIP trunks, including restriction information) and TON.

In the originating exchange the complete number is composed of the A party directory number and exchange numbers which are stated in the parameters *EXNOPR* and *EXNOPU*, see 5.2.4 *Public numbers* on page 20 and 5.2.5 *Private numbers* on page 21.

What *EXNOPU*, *EXNOPR* -values to choose depends of the value (0-4 and 5-7 respectively) stated in the respective TON (for the ADC parameter in the RODDI command). The values in the parameters *EXNOPR*, *EXNOPU*, and ADC must be initiated with regard to the connected exchanges.

The calling party number (directory number or ROUDIR) can if necessary be converted by the command `number_conversion_initiate`, using the parameter `-conversionnumbertype = 'sent A number` and `sent connected number`, and a corresponding value in the `-numbertype` parameter.

It is possible to send different calling party numbers, depending on destination and selected route.

Common public directory number as calling party number

According to called, calling and connected party number, the same rules mentioned in the section above are applicable for initiating common public directory numbers.

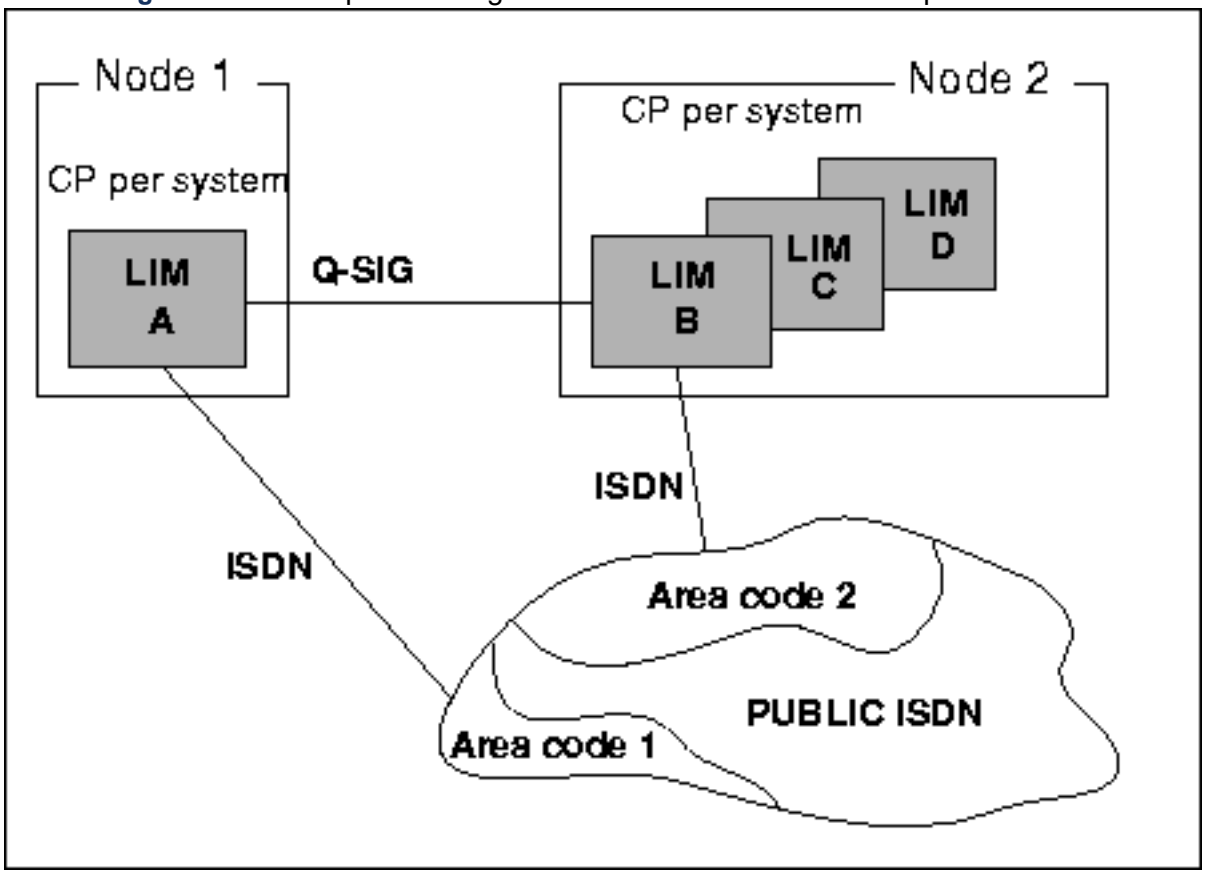
Additions are:

In the *KSEXI* or *EXTEI* commands, network affiliation shall be stated in parameter ADC if the calling party number is not possible or not allowed to be sent to the PSTN. In *extension_profile -i* the network affiliation in *--ext-npres* shall also be set appropriately.

If the calling party number of the A-party is not possible or not allowed to be sent, a calling party number using the common public directory number (stated in command `route_data_common`) with relevant exchange numbers and TON can be sent.

Common public directory number can only be initiated per system, per LIM and per customer.

Figure 1.15: Example of configuration where different common public numbers are used

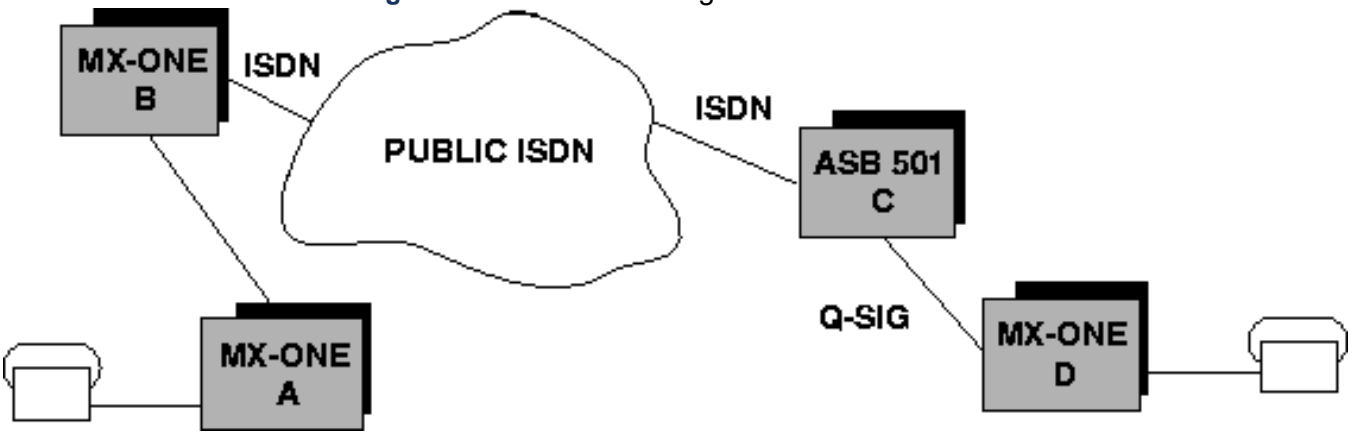


For extensions in LIM A, the common public directory number initiated for Node1 will be used for calls to public ISDN. For extensions in LIM B, C, and D, the common public directory number initiated for Node2 will be used for calls to public ISDN. The use of the above stated common public directory number is independent of how the call is routed.

ROUDIR as calling party number

If the calling party number is sent from exchange A, this number will be transferred transparently through exchange B to the public ISDN.

Figure 1.16: A call transiting several MX-ONE Service Nodes



If the tie line A-B does not support calling party identity transfer, or if no calling party number is sent from exchange A, the B exchange will compose a calling party number to be sent to the ISDN by means of:

1. Exchange numbers for outgoing public route (EXNOPU) + ROUDIR for the incoming tie line route. The parameters are initiated per route.
2. Or, if no ROUDIR is defined for the incoming tie line route, no number will be sent to the ISDN.

The following commands are used to control calling number:

Command	Parameters
route_data_common -i	--public-directory-number, --public-number
RODDI	ADC
RONDI	EXNOPU, EXNOPR, ROUDIR

Calling Party Number

The calling party number (A-party) can be conveyed to the called party if the intermediate **signaling system supports** this. The calling party number consists of the complete calling number (A-party) (in some cases, with SIP trunks, including restriction information) and TON.

In the originating exchange the complete number is composed of the A party directory number and exchange numbers which are stated in the parameters *EXNOPR* and *EXNOPU*, see 5.2.4 *Public numbers* on page 20 and 5.2.5 *Private numbers* on page 21.

What *EXNOPU*, *EXNOPR* -values to choose depends of the value (0-4 and 5-7 respectively) stated in the respective TON (for the ADC parameter in the RODDI command). The values in the parameters *EXNOPR*, *EXNOPU*, and ADC must be initiated with regard to the connected exchanges.

The calling party number (directory number or ROUDIR) can if necessary be converted by the command `number_conversion_initiate`, using the parameter `-conversionnumbertype = 'sent A number` and `sent connected number`, and a corresponding value in the `-numbertype` parameter.

It is possible to send different calling party numbers, depending on destination and selected route.

Common public directory number as calling party number

According to called, calling and connected party number, the same rules mentioned in the section above are applicable for initiating common public directory numbers.

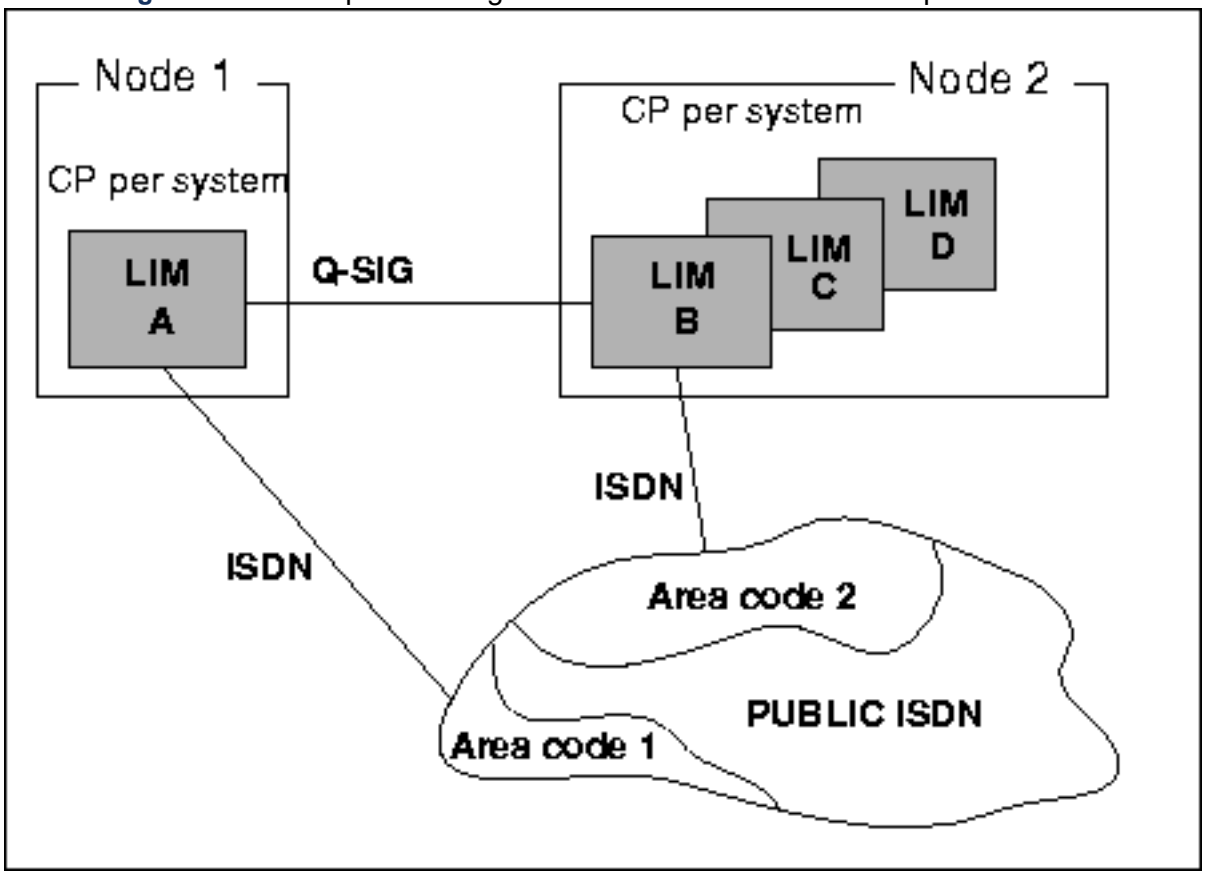
Additions are:

In the *KSEXI* or *EXTEI* commands, network affiliation shall be stated in parameter ADC if the calling party number is not possible or not allowed to be sent to the PSTN. In *extension_profile -i* the network affiliation in *--ext-npres* shall also be set appropriately.

If the calling party number of the A-party is not possible or not allowed to be sent, a calling party number using the common public directory number (stated in command `route_data_common`) with relevant exchange numbers and TON can be sent.

Common public directory number can only be initiated per system, per LIM and per customer.

Figure 1.17: Example of configuration where different common public numbers are used

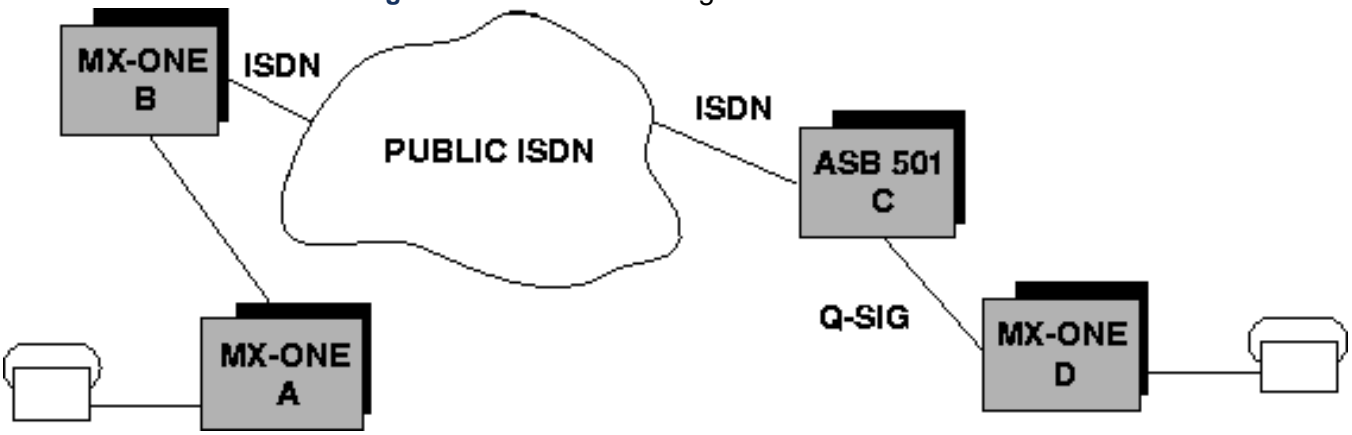


For extensions in LIM A, the common public directory number initiated for Node1 will be used for calls to public ISDN. For extensions in LIM B, C, and D, the common public directory number initiated for Node2 will be used for calls to public ISDN. The use of the above stated common public directory number is independent of how the call is routed.

ROUDIR as calling party number

If the calling party number is sent from exchange A, this number will be transferred transparently through exchange B to the public ISDN.

Figure 1.18: A call transiting several MX-ONE Service Nodes



If the tie line A-B does not support calling party identity transfer, or if no calling party number is sent from exchange A, the B exchange will compose a calling party number to be sent to the ISDN by means of:

1. Exchange numbers for outgoing public route (EXNOPU) + ROUDIR for the incoming tie line route. The parameters are initiated per route.
2. Or, if no ROUDIR is defined for the incoming tie line route, no number will be sent to the ISDN.

The following commands are used to control calling number:

Command	Parameters
route_data_common -i	--public-directory-number, --public-number
RODDI	ADC
RONDI	EXNOPU, EXNOPR, ROUDIR

Connected Party Number

If the connected party differs from the called party (for example, after transfer), the connected party number may be used, for example, for display purposes, that is, on condition that the signaling system supports this. Apart from how the TON to use is found, the complete connected number is composed in the same way as the complete calling number is composed. The TON to use is the received TON from the calling party.

The following command is used to control the connected number:

Command	Parameter
RONDI	EXNOPUEXPNOPR

Public Numbers

Exchange Number <=>	Parameter	Example
Country code	EXNOPU=2-CC	EXNOPU=1-46
Trunk code	EXNOPU=2-NDC	EXNOPU=2-8

Exchange Number <=>	Parameter	Example
Local code	EXNOPU=4-LOCPU	EXNOPU=4-68
Network specific	EXNOPU=3-NSP	EXNOPU=3-999
Unknown public	EXNOPU=0-UNPC	EXNOPU=0-46868
Type of number =	**TON**	**How to compose a complete number for this TON**
International	1	Country Code + Trunk Code + Subscriber number (Local Code +Directory number)
National	2	Trunk code + Subscriber number (Local Code +Directory number
Local Public	4	Subscriber number (Local Code + Directory number)
Network Specific	3	Network specific + Directory number
Unknown Public	0	Unknown Public + Directory number

Private Numbers

Exchange Number <=>	Parameter	Example
Location code (Level 1 regional)	EXNOPR=7-LEV1RC	EXNOPR=7-850
Location code (Local private)	EXNOPR=6-LOCPR	EXNOPR=6-4
Unknown Private	EXNOPU=5-UNPR	EXNOPR=5-8504
Network specific	EXNOPU=3-NSP	EXNOPU=3-999
Unknown public	EXNOPU=0-UNPC	EXNOPU=0-46868
Type of number =	**TON**	**How to compose a complete number for this TON**
Level 1 Regional	7	Location code (Level 1 Regional) +Location code (Localprivate) + Directory number
Local private	6	Location code (Local private) + Directory number

Exchange Number <=>	Parameter	Example
Unknown private	5	Unknown Private code + Directory number

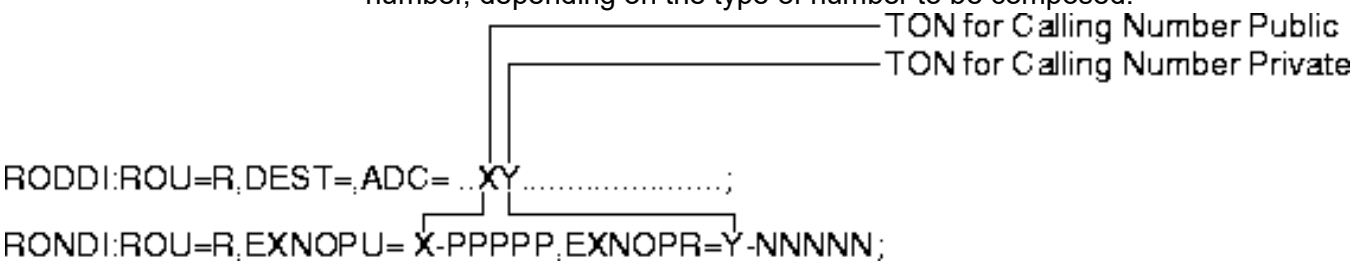
Examples

Binding between RODDI and RONDI

It is parameter ADC in RODDI and parameter EXNOPU or EXNOPR in RONDI that control the composing of a complete calling number.

In ADC, the TON for calling public number is connected to the EXNOPU values. These are used to compose the calling public number. Also in ADC, the TON for calling private number is connected to the EXNOPR values. These are used to compose the calling private number.

Figure 1.19: One or many exchange numbers are used to compose the complete calling number, depending on the type of number to be composed.



Initiation of Common Public Directory Number per System

Common Public Directory number is used when the internal directory number series is not included in the Public Exchanges DID series. All extensions in the MX-ONE Service Node that are not DID-extensions must be initiated with the category Not allowed to send CLI.

For generic extensions (`extension_profile` command) *--ext-npres* (D3)=0 Network Affiliation.

For DTS (KS commands) ADC(D10)=0 Network Affiliation.

For ATS (EX commands) ADC(D9)=0 Network Affiliation.

number_initate-numbertype cp -number...
extension_profile --ext-npres xx0xxx
*KSEXI:*DIR=,ADC=.....0;
*EXTEI:*DIR=,ADC=.....0;
route_data_common -i --public-directory-number xxx --public-number xxxx

Initiation of exchange numbers per route

The exchange numbers are used with the directory number to compose a complete calling number.

number_initate-numbertype ed -number...
*RONDI:*ROU=,EXNOPU=0-UNPU;
*RONDI:*ROU=,EXNOPU=1-CC;
*RONDI:*ROU=,EXNOPU=2-NDC;
*RONDI:*ROU=,EXNOPU=3-NSP;
*RONDI:*ROU=,EXNOPU=4-LOCPU;
*RONDI:*ROU=,EXNOPU=5-UNPR;
*RONDI:*ROU=,EXNOPU=6-LOCPR;
*RONDI:*ROU=,EXNOPU=7-LEV1RC;

Initiation of ROUDIR

The parameter is used when an incoming route does not convey the calling number. The number stated in ROUDIR is used as a directory number when composing the complete calling number.

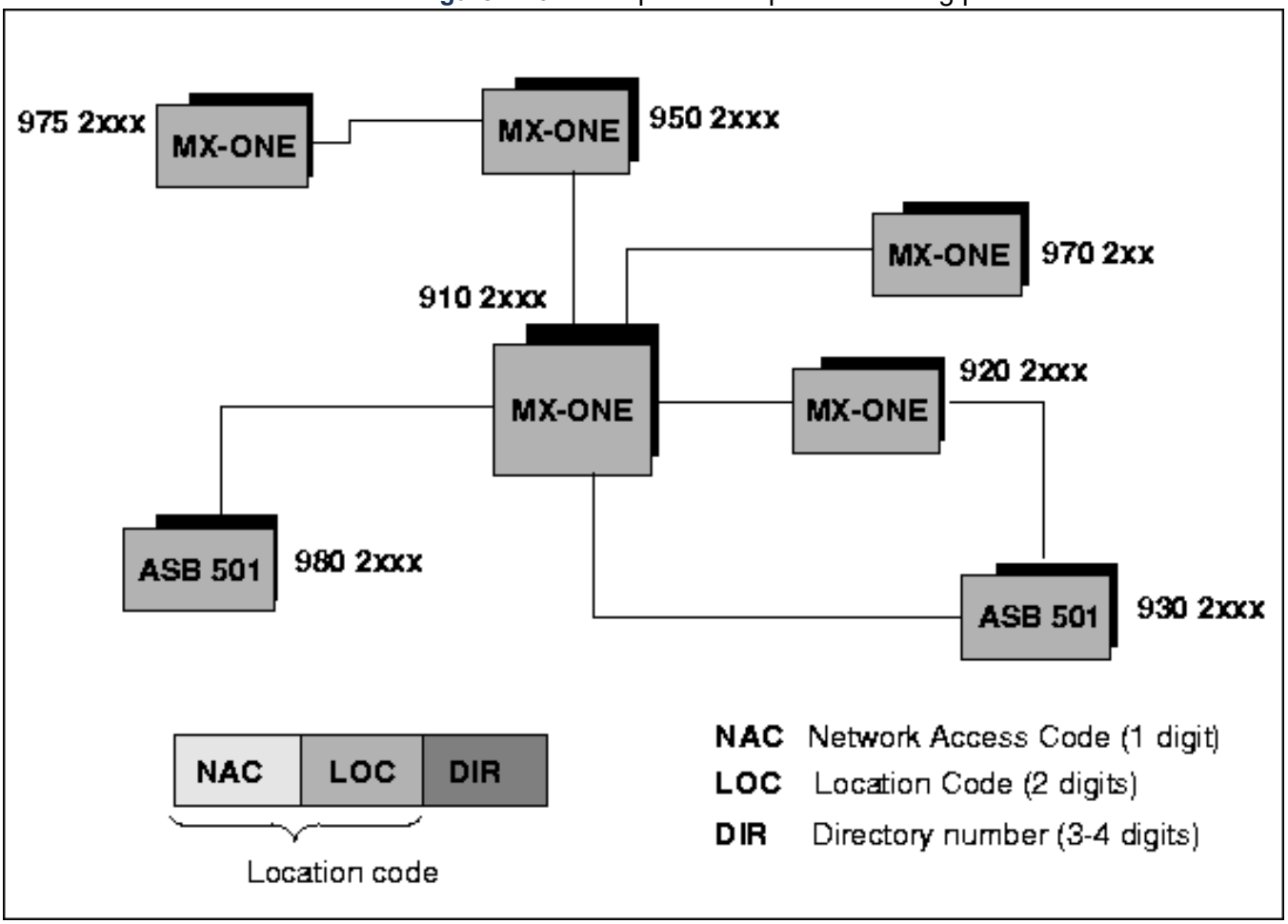
number_initate-numbertype ed -number...
*RONDI:*ROU=(incoming route),ROUDIR=;

Descriptions of Initiation of Different Numbering Plans

The examples mentioned below all depend on if the signaling system supports calling, called, and connected number handling. A signaling system like ISDN is required, otherwise there is no support for the feature.

Open Numbering Plan or Location Code Based Numbering Plan (Uniform Numbering Plan)

Figure 1.20: Example of an open numbering plan



Characteristics for a private network with open numbering plan are:

- Location code (LOC) is used
- The Location code may include a Network Access Code (NAC), (Optional)
- Mixed number length is permitted in the same network. This applies to both location codes and directory numbers.
- Exchanges may have extensions with identical directory numbers.
- The complete dialed number is not always distributed in the network as called number.
- If calling number is possible to send, exchange numbers are used to compose the complete calling number to send.
- If TONs are possible to convey with the calling or connected number, an exchange number table shall be initiated in each of the exchanges for each of the used TONs in order to be able to compose the complete calling or connected number

In MX-ONE, the NAC and the location code are not analyzed separately but handled as one location code.

The external destinations in each of the exchanges are initiated using -numbertype =ed:

number_initate-**numbertype ed -number ...**

Own exchange numbers are also stated for each node using -numbertype = en.

number_initate-**numbertype en -number ...**

The route access codes are defined with the command RODDI.

***RODDI:*DEST=...,ROU=...,ADC=** D2D3D4 .. ,SRT=...

D2 in ADC states the TON for the called number. The TON for the called number is normally used by public exchanges.

D3 states the TON for the calling number public.

D4 states the TON for the calling number private.

The TON values of D3 and D4, define which exchange numbers to use from the exchange number table together with the directory number when composing the complete calling/connected number.

The exchange number table is built up using command `RONDI`:

***RONDI*:ROU=...,EXNOPU=0-(Code for Unknown public);**

***RONDI*:ROU=...,EXNOPU=1-(Code for Country code);**

***RONDI*:ROU=...,EXNOPU=2-(Code for Trunk code);**

***RONDI*:ROU=...,EXNOPU=3-(Code for Network specific);**

***RONDI*:ROU=...,EXNOPU=4-(Code for Local code);**

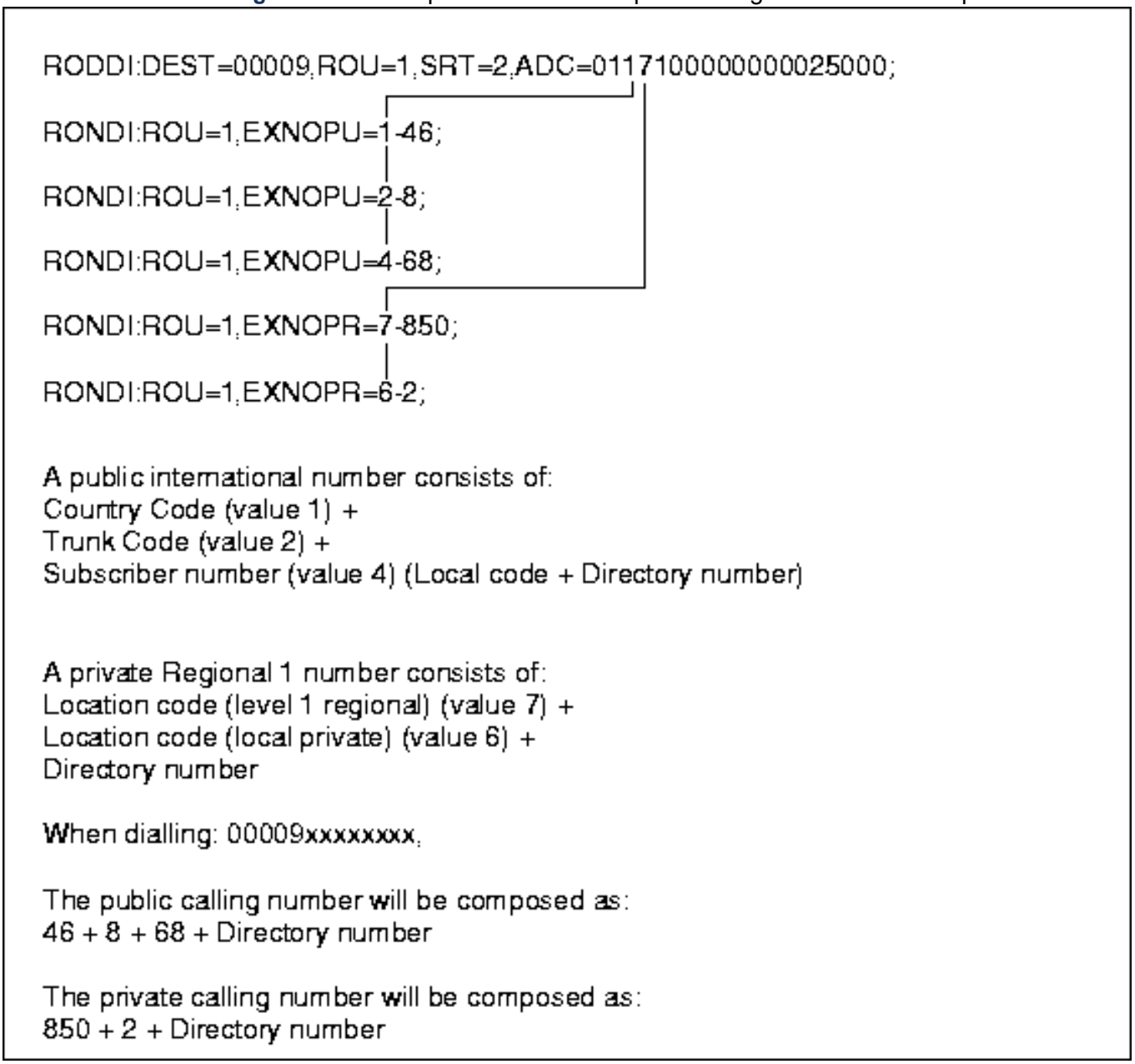
***RONDI*:ROU=...,EXNOPR=5-(Code for Unknown private);**

***RONDI*:ROU=...,EXNOPR=6-(Code for Local private);**

***RONDI*:ROU=...,EXNOPR=7-(Code for Level 1 Regional);**

NOTE: There is a connection between RODDI and RONDI regarding the ADC parameter values for calling number TON (public and private).

Figure 1.21: Example of how the complete calling numbers are composed

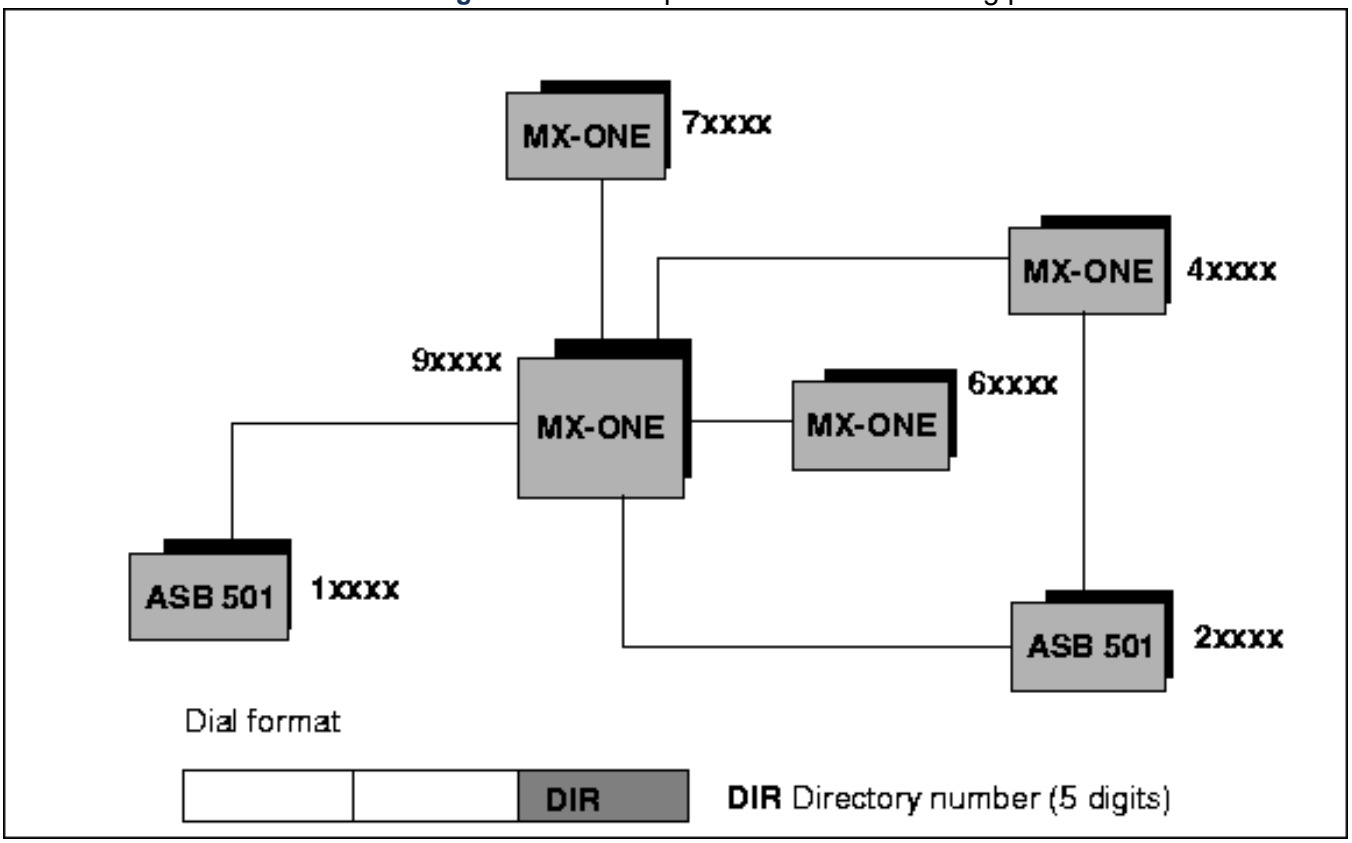


The composed Connected number is defined by received TON of the Calling party number.

In order to make display and network services to work properly, the private exchange numbers that prefix the directory number (stated by `EXNOPR` in the `RONDI` command) also have to be initiated as own exchange numbers. This is because if a part of the number is found to be own exchange number, the MX-ONE Service Node removes these parts of the number before displaying or executing a network service.

***number_initate*-numbertype en -number 'own exchange number (local private exchange number & level 1 Regional exchange number)'**.

Figure 1.22: Example of a closed numbering plan.



Characteristics for a private network with closed numbering plan are:

- The total number length is fixed
- Only directory number is used, without any location code (that is, no exchange numbers are necessary)
- The complete dialed number is distributed within the network as called number

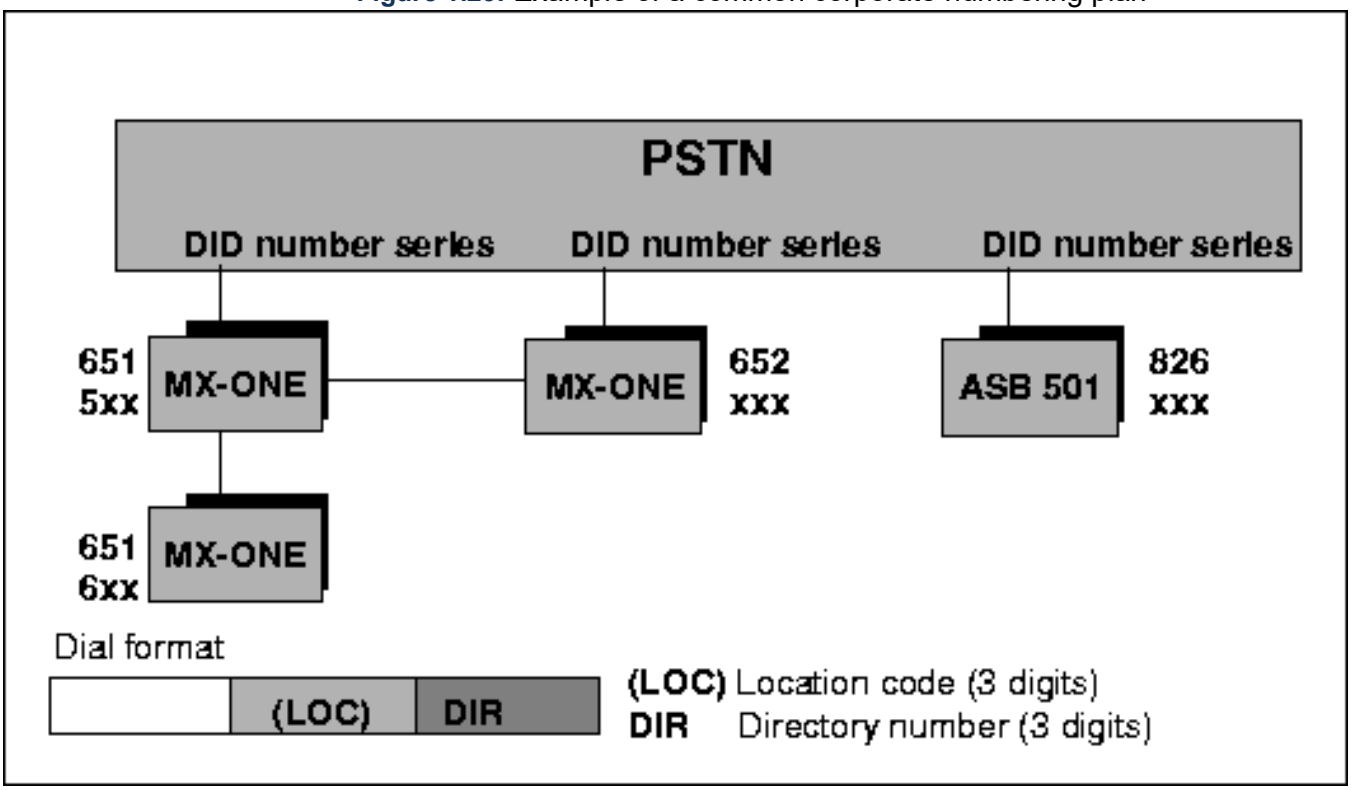
Since it is a closed numbering plan the external destinations shall in each exchange be initiated using -numbertype = ec:

***number_initate*-numbertype ec -number...** (1, 2 or 3 digits of the directory number for addressing other exchanges)

The route access codes are defined with command `RODDI` and parameter `DEST`.

Common Corporate Numbering Plan

Figure 1.23: Example of a common corporate numbering plan



Each exchange has its own numbering plan, except the routing numbers to other exchanges in the network, which are common in the network and correspond with the own exchange identity.

Characteristics for a private network of this type:

- Some exchanges are connected via tie line, some via PSTN
- Some exchanges of the network use fixed number length
- The number length is permitted to vary
- The location code (exchange identity) is used for routing purpose
- If calling number is possible to send, exchange numbers are used to compose the complete calling number to send
- If TONs are possible to convey with the calling/connected number, an exchange number table shall be initiated in each of the exchanges for each of the used TONs in order to be able to compose the complete calling connected number

The external destinations in each exchange are initiated using -numbertype = ec for parts of the private network with a closed numbering plan.

***number_initate*-numbertype ec -number...**

For other external destinations -numbertype = ed is used.

***number_initate*-numbertype ed -number...**

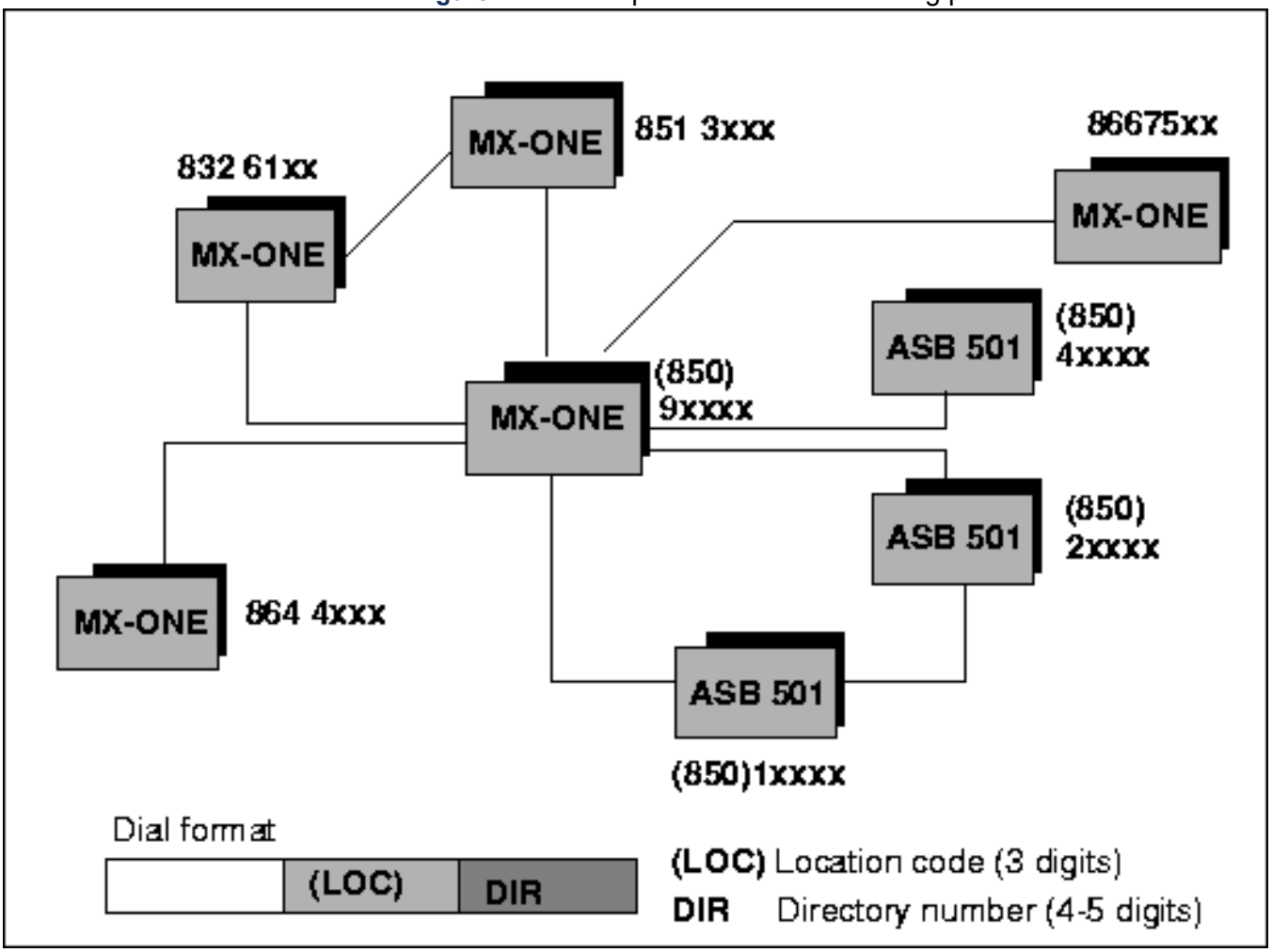
Own exchange numbers are stated for each exchange with

***number_initate*-numbertype en -number...**

The route access codes are defined with command RODDI and parameter DEST. For routing via the public network it is possible to modify the called or dialed number that is sent to the PSTN, that is, the corporate number is modified to a public directory number.

Mixed Numbering Plan

Figure 1.24: Example of a mixed numbering plan



As the name implies, this number plan is a mixture of both an open numbering plan and a closed numbering plan. Therefore the same characteristics mentioned earlier are applicable for this type of numbering plan also.

NOTE: The handling of NPI unknown in ASP113 is controlled by an O&M parameter (TL60, VARC). The default behavior is for a received number with NPI unknown to be set as ASP113's TON "unknown public".

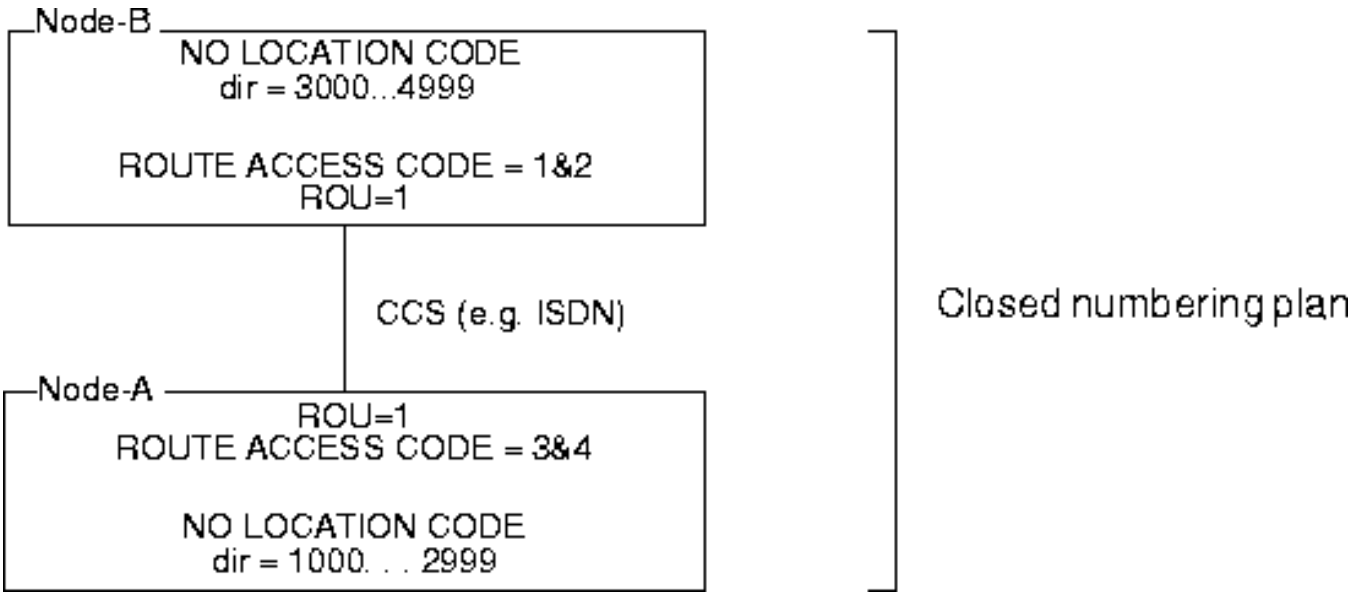
General Numbering Execution Examples

Example 1

A MX-ONE Service Node with only one route to another MX-ONE Service Node. The external line can convey calling and connected number. It is also possible to send TON together with the number.

The two exchanges use a closed numbering plan (that is, no conflicting directory numbers). The first digit of the cooperating exchange directory number series is used as route access code.

Public numbers and TON are not relevant, since this is only within the own private network and the private number has priority over the public number regarding the display.



Execution in Node-A

number_initate-numbertype ex -number 1000..2999 *number_initate*-numbertype ec -number 3,4 *RODDI:*ROU=1,DEST=3,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx; *RODDI:*ROU=1,DEST=4,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;

Execution in Node-B

number_initate-numbertype ex -number 3000..4999 *number_initate*-numbertype ec -number 1,2 *RODDI:*ROU=1,DEST=1,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx; *RODDI:*ROU=1,DEST=1,SRT=2,ADC=x6x6xxxxxxxxxxxxx...xxxxx;

Calling/connected/called number

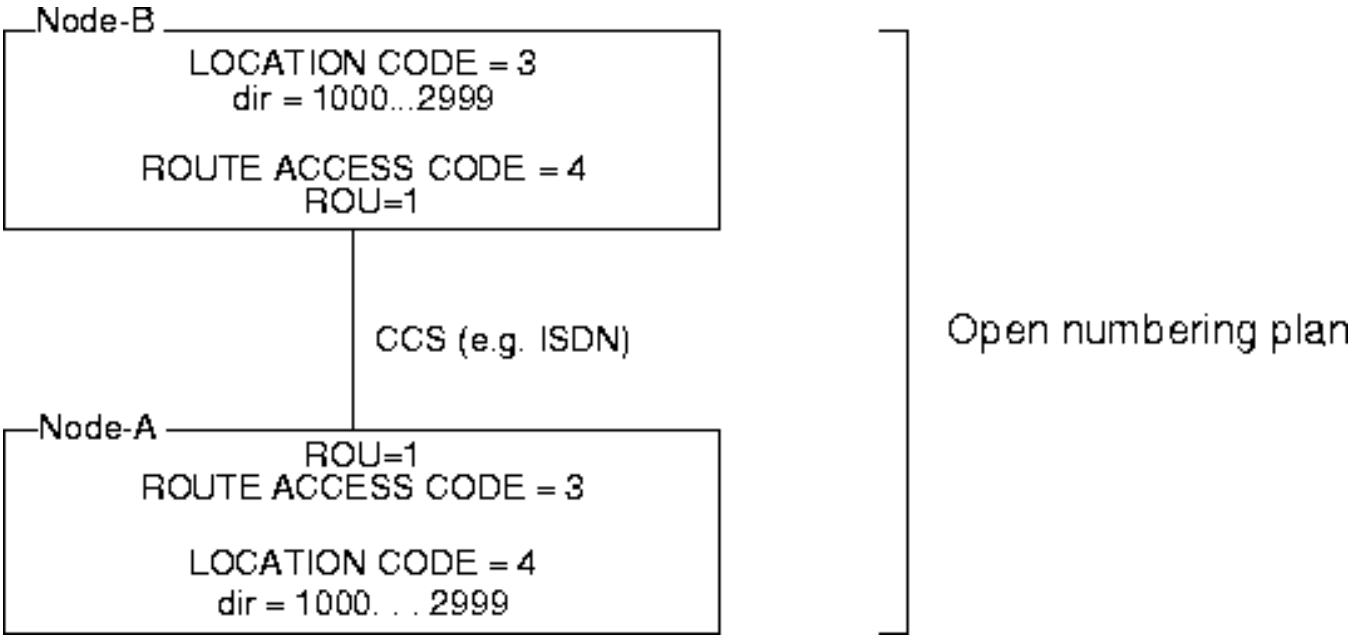
Extension dir=1555 in Node-A dials: 3555	
In Node-A	
Called number	3555 (TON=6) sent to Node-B
Calling number Private	1555 (TON=6) sent to Node-B
Connected number Private	3555 (TON=6) received from Node-B

Example 2

A MX-ONE Service Node with only one route to another MX-ONE Service Node. The external line can convey calling and connected number. It is also possible to send TON together with the number.

Route access code is used to prefix the directory number since the directory number series are the same in both exchanges.

Public numbers and TON are not relevant, since this is only within the own private network and the private number has priority over the public number regarding the display.



Execution in Node-A

```
number_initate-numbertype en -number 4
number_initate-numbertype ex -number 1000..2999
number_initate-numbertype ed -number 3
RODDI:ROU=1,DEST=3,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
RODDI:ROU=1,EXNOPR=6-4;
```

The EXNOPR D1 value corresponds to the ADC D4 value (6) for TON = Local Private Number.

Execution in Node-B

```
number_initate-numbertype en -number 3
number_initate-numbertype ex -number 1000..2999
number_initate-numbertype ed -number 4
RODDI:ROU=1,DEST=4,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
RODDI:ROU=1,EXNOPR=6-3;
```

The EXNOPR D1 value corresponds to the ADC D4 value (6) for TON = Local Private Number.

Calling/connected/called number

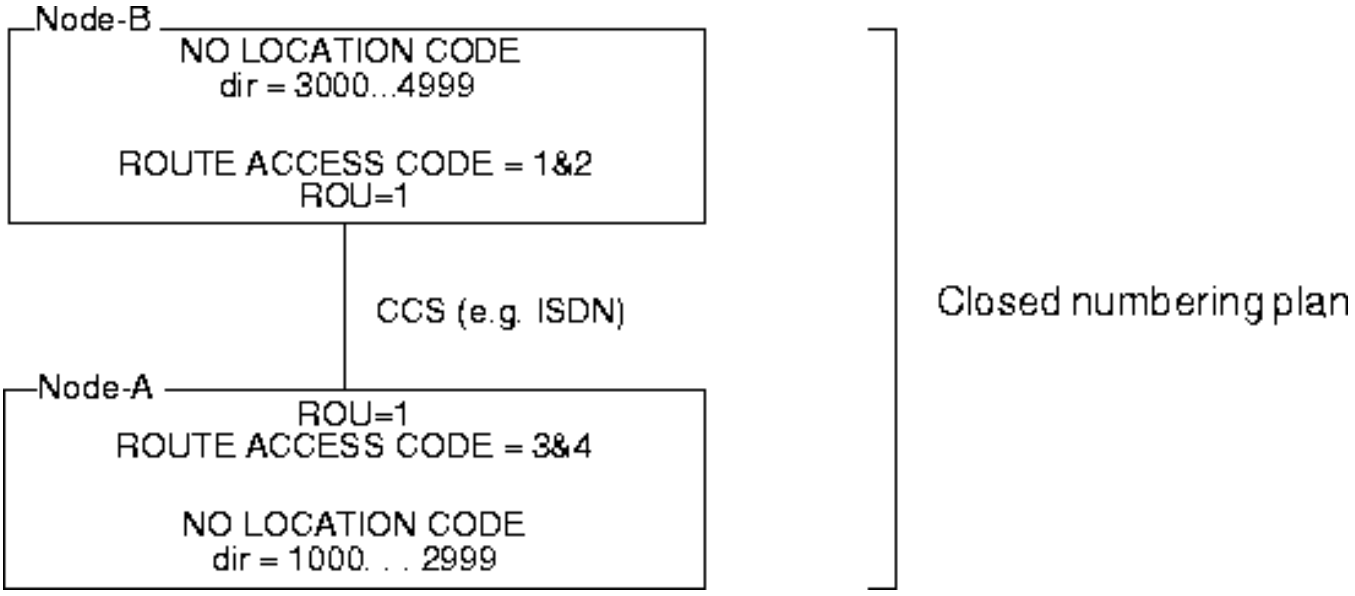
Extension dir=1555 in Node-A dials: 3555	
In Node-A	
Called number	31555 (TON=6) sent to Node-B
Calling number Private	41555 (TON=6) composed and sent to Node-B
Connected number Private	3555 (TON=6) received from Node-B

Example 3

A MX-ONE Service Node with only one route to another MX-ONE Service Node. The external line can convey calling and connected number. It is also possible to send TON together with the number.

The two exchanges use a closed numbering plan (that is, no conflicting directory numbers). The first digit of the cooperating exchange directory number series is used as route access code.

Public numbers and TON are not relevant, since this is only within the own private network and the private number has priority over the public number regarding the display.



Execution in Node-A

```
number_initate-numbertype ex -number 1000..2999
number_initate-numbertype ec -number 3,4
number_initate-numbertype ed -number 3
RODDI:ROU=1,DEST=3,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
RODDI:ROU=1,DEST=4,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
```

Execution in Node-B

number_initate-numbertype ex -number 3000..4999 *number_initate*-numbertype ec -number 1,2 *number_initate*-numbertype ed -number 4 *RODDI:*ROU=1,DEST=1,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx; *RODDI:*ROU=1,DEST=2,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;

Calling/connected/called number

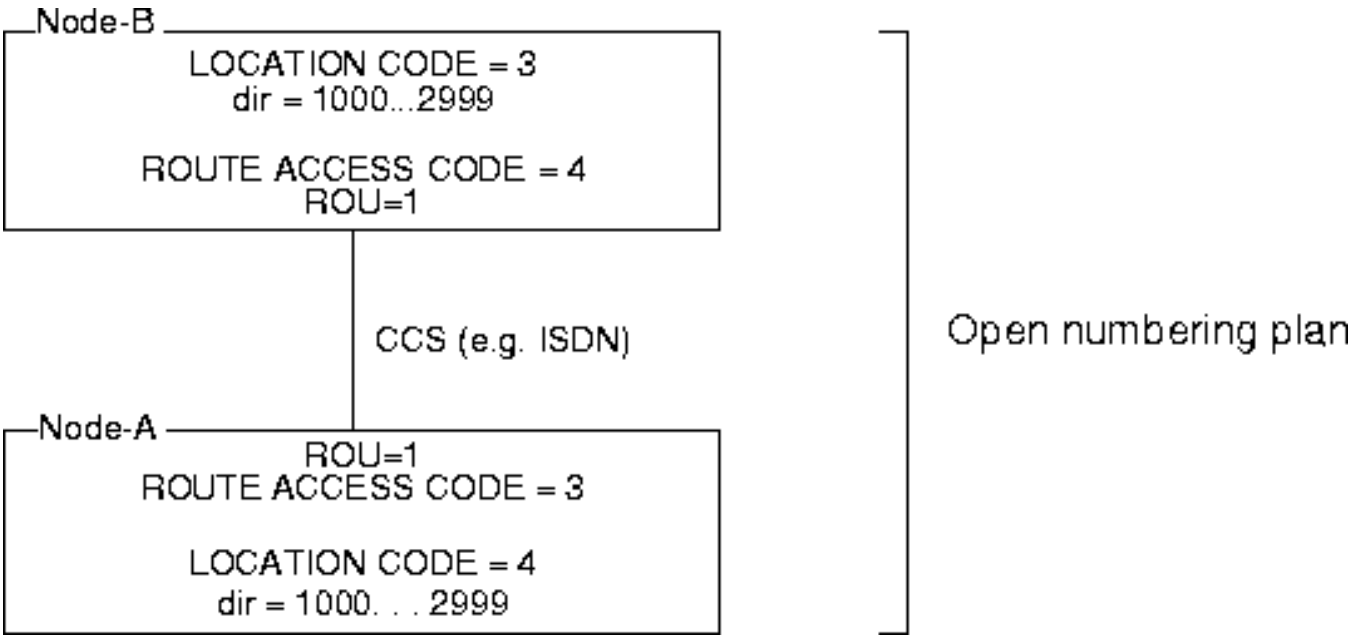
Extension dir=1555 in Node-A dials: 3555	
In Node-A	
Called number	3555 (TON=6) sent to Node-B
Calling number Private	1555 (TON=6) sent to Node-B
Connected number Private	3555 (TON=6) received from Node-B

Example 4

A MX-ONE Service Node with only one route to another MX-ONE Service Node. The external line can convey calling and connected number. It is also possible to send TON together with the number.

Route access code is used to prefix the directory number since the directory number series are the same in both exchanges.

Public numbers and TON are not relevant, since this is only within the own private network and the private number has priority over the public number regarding the display.



Execution in Node-A

```
number_initate-numbertype en -number 4
number_initate-numbertype ex -number 1000..2999
number_initate-numbertype ed -number 3
RODDI:ROU=1,DEST=3,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
RODDI:ROU=1,EXNOPR=6-4;
```

The EXNOPR D1 value corresponds to the ADC D4 value (6) for TON = Local Private Number.

Execution in Node-B

```
number_initate-numbertype en -number 3
number_initate-numbertype ex -number 1000..2999
number_initate-numbertype ed -number 4
RODDI:ROU=1,DEST=4,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
RODDI:ROU=1,EXNOPR=6-3;
```

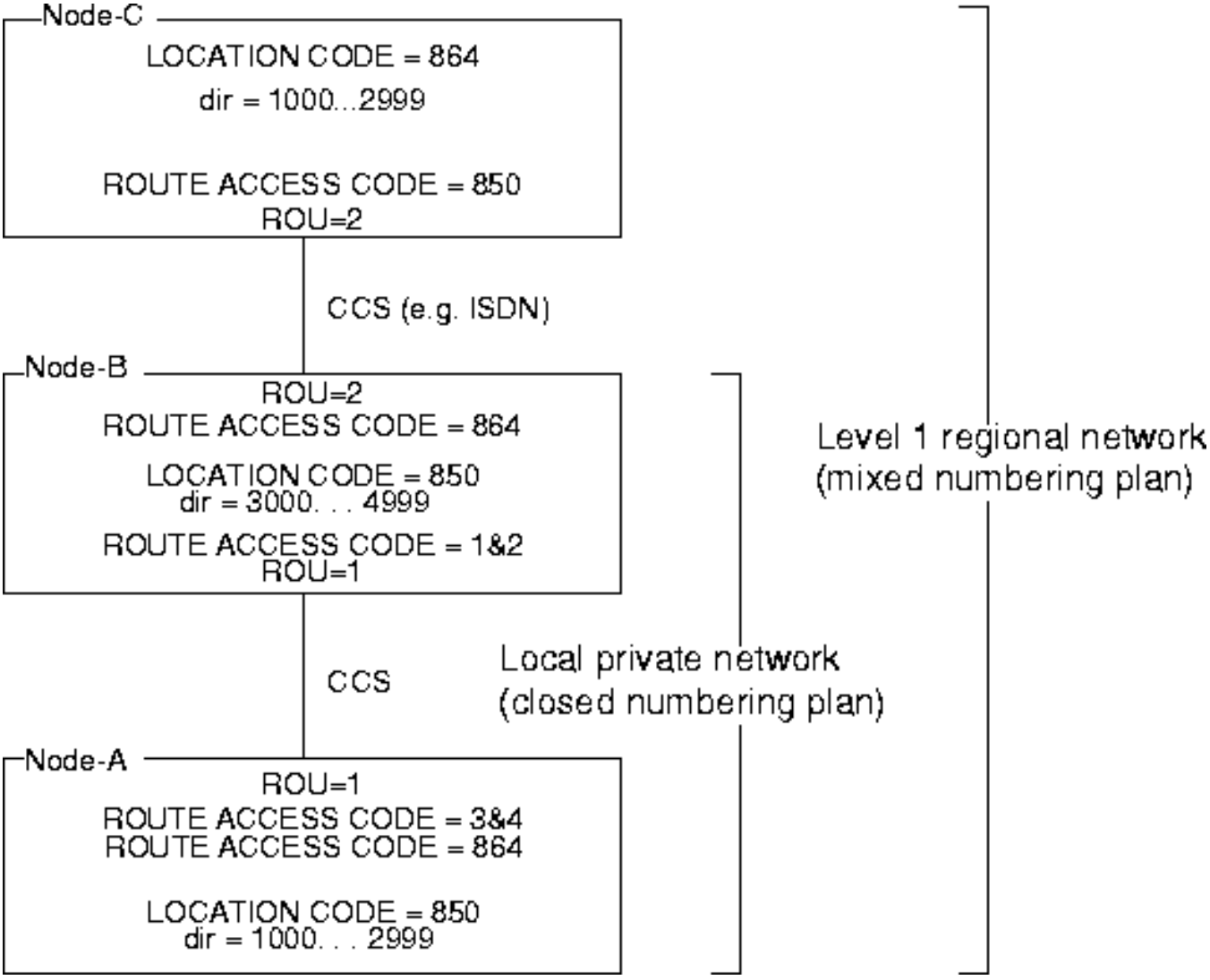
Calling/connected/called number

Extension dir=1555 in Node-A dials: 3555	
In Node-A	
Called number	31555 (TON=6) sent to Node-B
Calling number Private	41555 (TON=6) composed and sent to Node-B
Connected number Private	31555 (TON=6) received from Node-B

Example 5

Three MX-ONE Service Nodes are connected. The external line can convey calling and connected number. It is also possible to send TON together with the number.

Public numbers and TON are not relevant, since this is only within the own private network and the private number has priority over the public number regarding the display.



Execution in Node-A

number_initate-numbertype en -number 850
number_initate-numbertype ex -number 1000..2999
number_initate-numbertype ed -number 3,4
*RODDI:*ROU=1,DEST=3,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
*RODDI:*ROU=1,DEST=4,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
*RODDI:*ROU=1,DEST=864,SRT=1,ADC=x7x7xxxxxxxxxxxxx...xxxxx;
*RODDI:*ROU=1,EXNOPR=7-850;

Execution in Node-B

number_initate-numbertype en -number 850
number_initate-numbertype ex -number 3000..4999
number_initate-numbertype ed -number 864
number_initate-numbertype ec -number 1,2
*RODDI:*ROU=1,DEST=1,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
*RODDI:*ROU=1,DEST=2,SRT=1,ADC=x6x6xxxxxxxxxxxxx...xxxxx;
*RODDI:*ROU=1,DEST=864,SRT=1,ADC=x7x7xxxxxxxxxxxxx...xxxxx;
*RODDI:*ROU=2,EXNOPR=7-850;

Execution in Node-C

number_initate-numbertype en -number 864
number_initate-numbertype ex -number 1000..2999
number_initate-numbertype ed -number 850
number_initate-numbertype ec -number 1,2
*RODDI:*ROU=1,DEST=850,SRT=1,ADC=x7x7xxxxxxxxxxxxx...xxxxx;
*RODDI:*ROU=2,EXNOPR=7-864;

Calling/connected/called number

Extension dir=1555 in Node-A dials: 3555	
In Node-A	
Called number	3555 (TON=6) sent to Node-B
Calling number Private	1555 (TON=6) sent to Node-B
Connected number Private	3555 (TON=6) received from Node-B

Extension dir=1555 in Node-A dials: 8641777

Extension dir=1555 in Node-A dials: 3555	
In Node-A	
Called number	8641777 (TON=7) sent to Node-B
Calling number Private	8501555 (TON=7) composed and sent to Node-B
Connected number Private	8641777 (TON=7) received from Node-C

In Node-B	
Called number	8641777 (TON=7) received from Node-A and sentto Node-C
Calling number Private	8501555 (TON=7) received from Node-A and sentto Node-C

Connected number Private	8641777 (TON=7) received from Node-C andsent to Node-A

In Node-C	
Called number	641777 (TON=7) received from Node-B
Calling number Private	8501555 (TON=7) received from Node-A
Connected number Private	8641777 (TON=7) composed and sent to Node-A

Termination

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