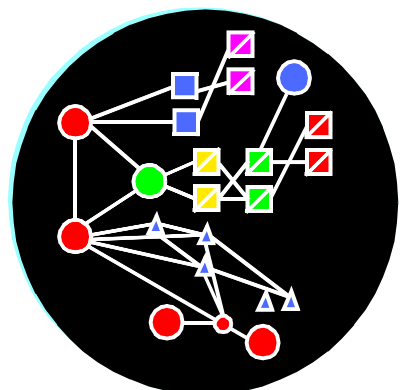
SS8 Networks
One Better

SS7 Tutorial



Global Title

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Before we get deeply into the subject of Global Title, it might help to get a very broad view of exactly what Global Title is. Simply defined, it is an address. But it is not an address of a node in the SS7 network (DPC, SSN). Instead, it is an alias for such an address that needs to be translated into an SS7 network address.

With that definition out of the way, let's quickly review what we know about SS7 addressing in general. To begin with, each User Part approaches addressing in a different way. The **MTP** (Message Transfer Part) has a job that is limited to reliably transferring messages over the links in a link set. That is, MTP only cares about the address of the node at the other end of the links it is tending. Therefore the only addressing the MTP requires is the SPC (Signalling Point Code) of the node at the end of its links. MTP sees this address as the Destination Point Code (DPC) of all messages it sends over the links. The only concern MTP has for any other location in the network is to be able to make use of the final destination of the message to help it pick out one link set from all the available linksets as the best one to use for sending the message. This is what MTP routing is all about.

ISUP addressing is different. In normal Call Control use, ISUP addresses a switch at the other end of its trunk connections. For the SS7, this too means using a Destination Point Code (DPC). But the switch ISUP talks to (which is the next switch in a circuit being set up or torn down) is not necessarily (and really not likely) to be located at the other end of its own SS7 links.

The job of addressing all other locations falls to the **SCCP**. Actually SCCP could be used to address the same switching locations as ISUP. If it were used in this way, SCCP could be used for end-to-end signal routing in conjunction with ISUP. But since the usual switch-to-switch routing of ISUP provides complete circuit information for all switches along the voice path, SCCP is rarely used in this way.

Like the other User Parts, SCCP can, and does, make use of DPC. This address alone can be used to get a message to any node in the global SS7 network in the same way that a telephone number can be used to address any telephone in the global telephone network. But SCCP addressing needs to go beyond this method of addressing. The reason is that at each DPC there is a "system" operating. That system may be a Call Control application or a database or some other program of some type.

The problem is that within that system there may be multiple applications running. Thus a Signalling Point Code (which is addressed as a Destination Point Code) may be the home of both a Credit Card Database and an 800 Number Database. Using the DPC as the SS7 address will get the message delivered to the “system” but it won’t get the message delivered to the appropriate database application. For this purpose, a separate identifier of a system within the system is required. That identifier is the **Subsystem Number (SSN)**.

It may be tempting to think of SSN as a database identifier. And, indeed, an SSN will be applied to a database even when only one database application is available at a specified DPC. But, avoid the temptation. The truth is that SSN is also used to sub-address any location at which multiple applications are running. For example, a switch offering several features may use SSN to separately identify each feature. Think of SSN as simply an application identifier.

That brings us to what you came for. The third addressing mechanism employed by SCCP is the **Global Title**, You might say this is the address used when the location requiring information doesn’t know the address. A Global Title implies the need for translation.

Before you become too confused, let’s try an example. If you dial an 800 number, the switch to which you are connected becomes more confused than you are right now. The reason is that every number to which the switch can route has a geographical reference which the switch maintains in its own routing table. In North America, the North American Numbering Plan (**NANP**) provides the clues for that routing. So, for example, if you dial a “1” first, the switch knows it must make a connection to a long distance switch. The long distance switch will choose from among its connections to route the call into the region suggested by the area code. Then the routing goes to the switch in the appropriate exchange code. And, finally, that switch selects the appropriate line number.

But you may have dialed 1-800-FLY-AWAY. The numbering plan is useless. The switch can’t even begin to make a connection. Instead, it sends a request into the SS7 network which essentially asks, ‘Will someone look this number up in an 800 database and translate it into an NANP number that I can route?” Such a number is returned and the switch proceeds as if that number had been dialed in the first place.

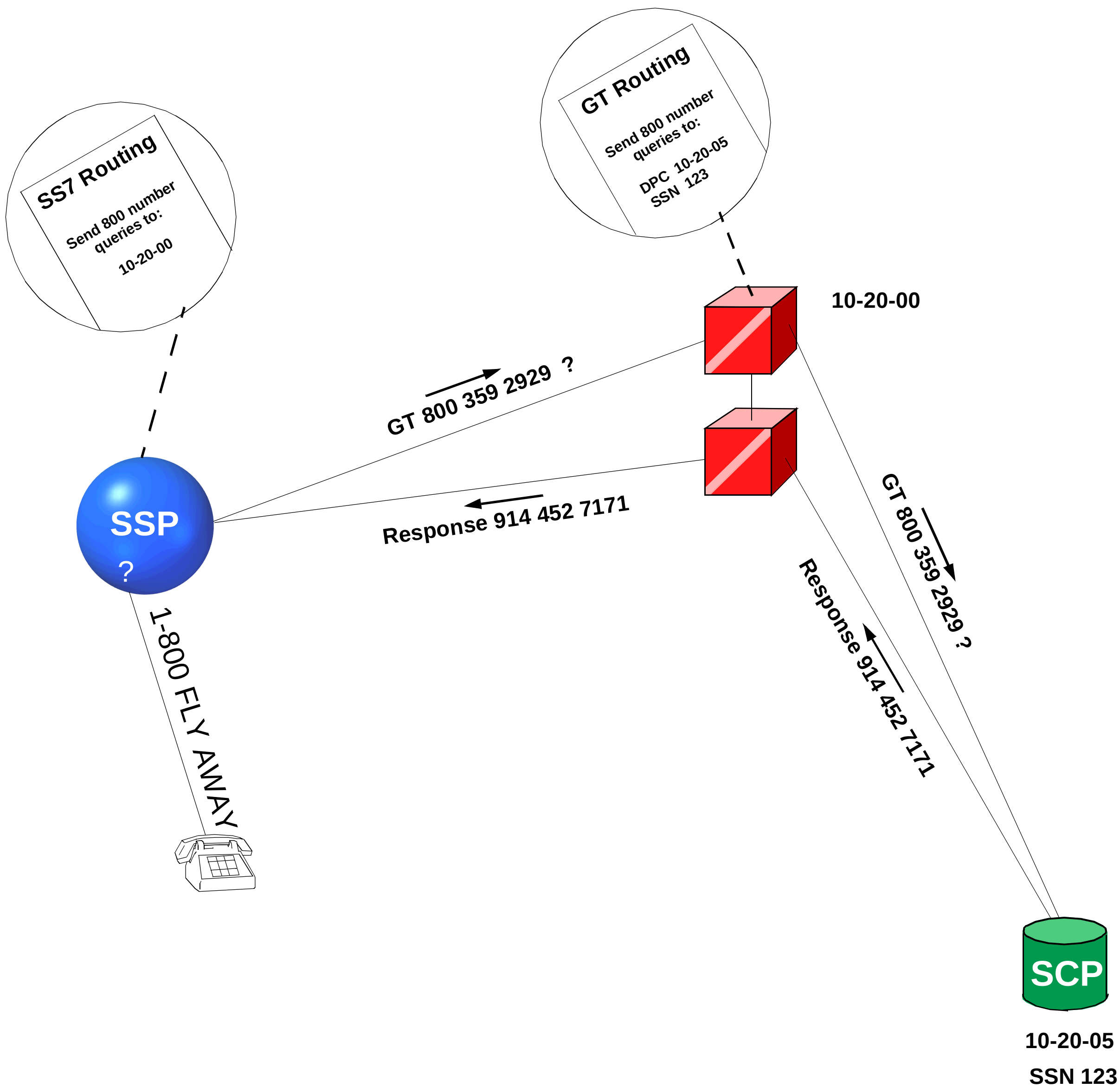
The switch can always get the information from such a database as long as it has the DPC and SSN of the 800 Number application in its SS7 routing table. But, therein lies a problem. Every day, new services are deployed into the SS7 network around the world. Some of them are proprietary and are, therefore, accessible only to the switches in the same proprietary network. Others are intended to be offered to other networks for a fee. So, here is the problem. If a service becomes universally available, does that mean that every switch on the planet needs to add the location (DPC) and identifier (SSN) to its SS7 routing table? Obviously if that were the case new services would spread slowly; and each switch would have to maintain huge tables of routing information.

A better answer is to keep that information at a much more limited number of locations in the network (such as STPs) and allow the switches to identify their requests for information without identifying where, or from what applications the information can be retrieved. That means that when a switch wants a translation, it need only identify the nature of the translation needed (for example, 800 number to NANP number) and send the request to a location whose routing table tells it where such translations can be performed. A single location in the routing table of the switch (such a location as an STP) may serve to provide 800 Number translations, 900 number translations, Credit Card validation, etc.

Even the first location which receives the request does not have to maintain a routing table of all locations on the globe. Instead, it may have a table which indicates that all requests in several similar categories should be sent to one location while requests in other categories can be sent somewhere else. All of this is possible because, with Global Title requests, the originator of the request does not need to know where or what application can provide the answer to the request.

Global Title has even more uses. For example, the STP may be able to send Dialed Digit translation requests to either of two databases at two different database nodes. The receipt of a Prohibited signal (indicating the database is unavailable) from the SCCP at one of the database locations can tell the STP to change its lookup to another Global Title Table. The translation there, in turn, can result in address information used to send queries to the backup location

The drawing below will illustrate the concept (but obviously not the coding) of Global Title queries. With the concepts firmly implanted we'll move on to the actual coding.



As an alias addressing mechanism, Global Title can obviate the need for ubiquitous ponderous routing tables. (Actually I just said that to see if you were still awake). It can also hide network assets and provide greater control for conditional rerouting requirements.

Perhaps the biggest mystery surrounding the use of Global title is the meaning of each of the fields in a Global Title message. We'll try to destroy that mystery next.

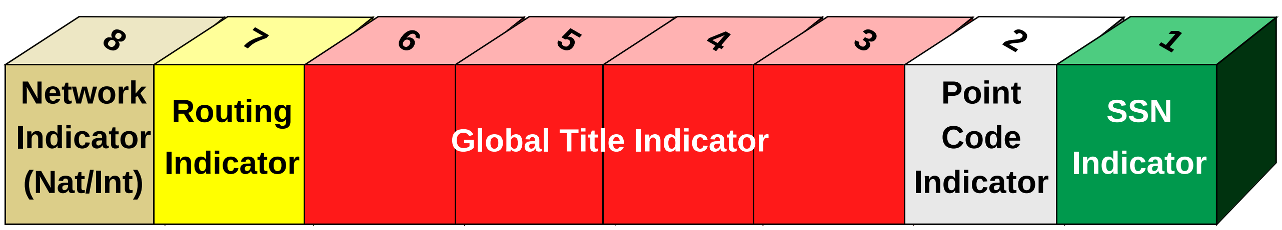
Calling/Called Party Address - To begin with, this contains all of the information required to identify the originator and the intended destination of the message. To understand why these values are important it might help to examine the way in which a Global Title request travels around the SS7 network.

1. An SSP receives dialed digits which it cannot use to route a call in the PSTN (e.g. an 800 number).

2. The switch consults its SS7 routing information to determine where to send the numbers for translation. If there is no information about the SS7 location of the translation table, the query may be sent to an intermediate STP whose routing table indicates where to send queries for translation. The message from the originating switch contains fields to indicate the full nature of the query.

Address Indicator - Foretells the type of addressing information to be found in the address field. This can be a single type of address or any combination of the address types Signalling Point Code, Global Title (e.g. Dialed Digits) and Subsystem Number. This field tells the receiving node what kind of addressing information to look for.

The following table indicates the significance of each of the bits in the octet with the bits numbered in the order in which they are sent/received.



Bits of the Address Indicator

The following tables list the contents of the Address Indicator bit by bit and indicate the significance of bit placement within the octet.

Bits #1-2	Signifies:
xxxxxxx1	The address contains an SSN
xxxxxx1x	The address contains an SPC

Bits #3-6	Signifies:
xx0000xx	No Global Title included
xx0001xx	Global Title Includes Translation Type, Numbering Plan and Encoding Scheme
xx0010xx	Global Title Includes Translation Type

Only three possible combinations of bits 3 through 6 are given in the table because the remaining combinations are either spares for National/International networks, are unassigned in the U.S., or are reserved for future use.

Since multiple address elements may be used, bit #7 is used to identify which of these elements should be used for routing,

Bit #7	Signifies:
x0xxxxxx	An SCCP translation is required. Therefore routing should be based on the Global Title in the address.
x1xxxxxx	An SCCP translation is not required. Therefore, routing should be based on the DPC (found in the Routing Label) and the SSN (found in the Called Party Address.

Bit 8 is used to identify the address as national or international as shown in the following table.

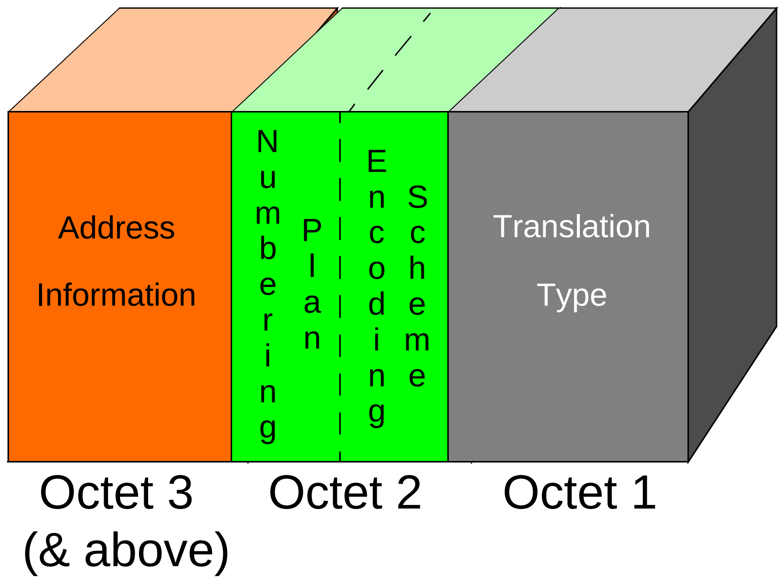
Bit #8	Signifies:
0xxxxxxx	Both the address indicator and the address are coded according to international specifications.
1xxxxxxx	Both the address indicator and the address are coded according to national specifications.

At this point it might be helpful to further explore both the Address Indicator and the actual Calling/Called Party Address. In the text preceding these tables we spoke of the actual address before we spoke of the Address Indicator. We did this in the hope of helping you to understand the need for the Address Indicator. In the message itself, the Indicator comes first. This allows the receiving side to determine how it must interpret the data in the Address before it has seen that data.

Following the Address Indicator comes the actual Called/Calling Party addressing. As can be seen from the Global Title Fields of the Address Indicator, the first octet of the Address may be a Translation Type. The next octets may be a Signaling Point Code, and the final octets may be the actual Global Title Address itself. We have repeatedly use the word *may* here because, as you can see from the Address Indicator, the Address may not even be a Global Title. As you can also see from the indicator, when Global Title is present, it may contain a Translation Type, a Numbering Plan, and an Encoding Scheme. We'll examine these values next.

Remember that we started by defining Global Title as an address. Subsystem Number and Signaling Point Code are also addresses. The difference is that the Global Title is an address of variable length and, perhaps of variable format which requires translation. For example, the Global Title may be the digits that were dialed which the switch was unable to use because they were not in North American Numbering Plan format.

Global Title Format
Following a Global Title Indicator value of 0001
In the Address Indicator



A glance back at bits 3-6 in the Address Indicator should serve to remind you that it can indicate there is no Global Title Address in the message. It can also indicate that there is a Global Title Address and that the address includes a Translation Type. Or, it can indicate that there is a Global Title Address and that the address includes Global Title Translation Type, Numbering Plan and Encoding Scheme

The previous paragraph contains some of the terms which seem to provide some of the greatest confusion over Global Title. You now have most of the information you need to understand Global Title. With a little luck, if we can clear up these final mysterious terms, all the pieces of Global Title should finally fall into place.

Translation Type - Global Title can be used in numerous ways. Therefore the possibility for many different applications requiring Global Title Addressing also exists. Such applications may be unique to a specific network, or they may be in use so generally that they are common to numerous networks. When the services of an application in one network are requested at a location outside that networking, certain internetworking applications may also be involved to transport requests and responses between networks.

For example, telephone calls can be charged using cards issued by service providers or by banks and other types of financial institutions. The caller is required to enter a PIN number when making the call so that an application can validate the card through a database application.

This is such a common application that the ANSI standard of 1996 has defined it as the Identification Card Application Group and has assigned to the Translation Type byte the value of 00000001 (decimal 1)

Other applications are becoming universally available, and, a a result both the most recent ANSI and ITU standards are beginning to assign values for these services so that they may be used as standardized values across the SS7 network at large. SCP assisted services (such as 800 number translations) are another group of universal services which have been assigned their own Translation Types.

Despite the growth of such commonly used services, the standards organizations have resisted the temptation to assign all 256 values which can be represented by the Translation Type byte. Indeed, under the ANSI standard an entire range of values (11000000 to 11111001) have been set aside for internal network usage. The table on the next page identifies the assignments in the ANSI standard.

Translation Type Coding		
Decimal Value	**Byte Values**	**Application/Translation Group**
0	**00000000**	reserved
1	**00000001**	Identification Cards
2	**00000010**	reserved*
3	**00000011**	Cellular Nationwide Roaming Service
4	**00000100**	Global Title = Point Code
5	**00000101**	Calling Name Delivery
6	**00000110**	reserved*
7	**00000111**	Message Waiting
8	**00001000**	SCP Assisted Call Processing
9 to 31	**00001001 to 00011111**	Internetwork Applications
32	**00100000**	spare
192 to 249	**11000000 to 11111001**	Network Specific Applications
250	**11111010**	Network Specific Applications
251	**11111011**	reserved*
252	**11111100**	Network Specific Applications
253	**11111101**	reserved*
254	**11111110**	**
255	**11111111**	reserved

Notes:

reserved* - The value 253 has been used for network specific applications as well as for the 14 digit Calling Card application while the value 251 has been used for both network specific applications and for the Call Management application.

** - The value 254 is already in use for some internetwork applications such as 800 service.Network providers not using this value are cautioned to consider potential conflicts before employing the same value for network specific applications.

Encoding Scheme - With the actual address value data coming up, the receiving node needs to recognize how many digits it should look for and how to translate these values from the binary code. These four bits present that information.

Code	Signifies:
0000	Unknown
0001	The address has an odd number of digits and should be converted to decimal values using Binary Coded Decimal (BCD) conversion.
	The address has an odd number of digits and should be converted to decimal values using Binary Coded Decimal (BCD) conversion.
0011 to 1111	Spare

The only remaining date preceding the actual address is the numbering plan (such as NANP) identifier.

The purpose of this tutorial has been to explore the concept, use and coding of Global Title. In the course of doing this, we have not examined the entire SCCP message formatting of which Global Title is a part. Our reference here has been the ANSI T1.112-96 Recommendations.

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