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Title

Proposed Revision to International Roaming Guide

Author

Watson Zan, P.Eng
Senior Industry Strategist
Network Strategy
Rogers Wireless Inc
1 Mount Pleasant Road
Toronto, Ontario, Canada
Tel#: 1-416-935-6031
Fax#: 1-416-935-7502
Email: wzan@rci.rogers.com

Abstract

The attached document is a revised International Roaming Guide proposed by Rogers Wireless Inc that basically changes the format and further enhances the content in order to make it easier to read, simpler to understand and quicker to adopt.

Rogers Wireless Inc requests the IFAST (International Forum on ANSI-41 Standards Technology) members to thoroughly review this document for further discussions, and recommends that the modified format and content as described in this revision be accepted as a new version and the new version be considered as a baseline document for future revisions, if deemed necessary.

NOTICE

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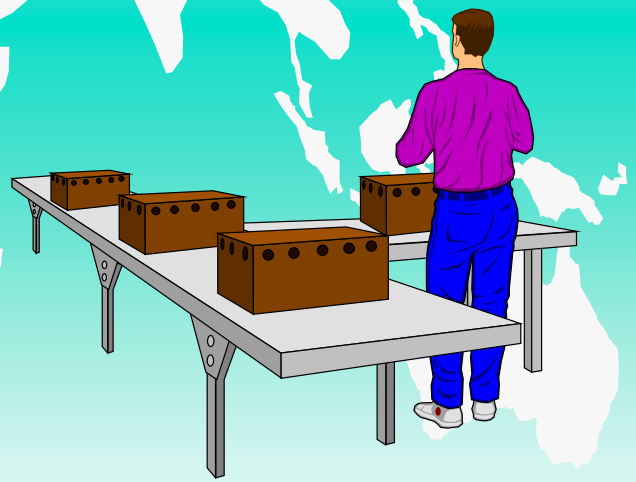
Proposed Revision
International Roaming Guide

Watson Zan, P.Eng

Senior Industry Strategist

Network Strategy

Rogers Wireless Inc.



Network Strategy

General Comments & Critiques

- Content Too Sketchy
- Formatting Not Consistent
- Information Inadequate
- Section Confusing
- Same Wording Repeated Many Times and Places

4W Questions

(Purpose: It is intended to provide guidance to international roaming service providers regarding issues related to and aspects of international roaming implementation)

- ***What** is the Issue?*
- ***Why** the Issue has impacts on International Roaming?*
- ***How** the Issue should/would be addressed and resolved?*
- ***What** are the IFAST proposals on implementation of the resolution(s) to that Issue based on an industry consensus*

Proposed Revision - Format

- **Three Main Sections**
  - Introduction
  - Issues
  - Glossary
- **Three Subsections under each Issue**
  - Description

    What is the Issue

    Why that Issue has an impact on International Roaming
  - Resolution

    How the Issue should be resolved
  - Recommendation

    What are the IFAST proposals on implementation of the resolution to that Issue based on an industry consensus

Proposed Revision - Content

- **Categorize the Issues:**
  - Numbering
  - Dialing
  - Signaling
  - Fraud
  - Billing
  - Service
  - Miscellaneous

Proposed Revision - Content

- **Categorize the Glossary:**
  - Billing Terminology
  - Industry Association
  - Network Element
  - Numbering Terminology
  - Standards Document
  - Standards Organization
  - Signaling Terminology
  - Technical Terminology

Matrix of Changes

ORIGINAL	REVISION
1. International Roaming 2. Introduction	Main Section I. Introduction *(Combine 1. & 2. And simplify wording)*
3. International Roaming MIN *(Description only)*	Subsection 1.1 *(Edited based on the new format)*
4. Separation of MIN and MDN *(Recommendation out of context, relating to IRM)*	Subsection 1.2 *(Edited based on the new format)*
5. SID Number	Subsection 1.3 *(Edited based on the new format)*
6. International TLDN	Subsection 1.4 *(Combine 6. & 7. And simplify wording)*
7. Nature of Number *(Should be part of TLDN)*	Subsection 1.4
8. International Mobile Subscriber Identifier	Subsection 1.5 *(Edited based on the new format)*
9. Identity of MSC	Subsection 1.6 *(Edited based on the new format)*
10. Uniform Dialing Plan	Subsection 2.1 *(Rearranged into Dialing Issues; Need Contributions)*
11. Support of Supplementary Services	Subsection 6.1 *(Rearranged into Services Issues)*
12. Emergency Number Dialing *(12.2,.3,.4 Optimal Routing is another issue, having nothing to do Emergency Number Dialing)*	Subsection 2.2 and 2.3 *(Rearranged into Dialing Issues; Need Contributions)*
13. Fraud Issues	Subsection 4.0 *(Edited based on the new format)*
14. *(Not exist)*	
15. Billing Issues	Subsection 5.0 *(Edited based on the new format)*
16. ANSI-41-/IS-41 Backward Compatibility	Subsection 3.1 *(Rearranged into Signaling Issues; Need Contributions)*
17. Tandem Free Operation	Subsection 7.2 *(Rearranged into Miscellaneous Issues; Need Contributions)*
18. SS7-Related Roaming Issues	Subsection 3.2 *(Rearranged into Signaling Issues; Need Contributions)*
19. Roaming Agreement Modeling	Subsection 7.1 *(Rearranged into Signaling Issues; Need Contributions)*
20. ANI Compatibility	Subsection 3.3 *(Rearranged into Signaling Issue; Need Contributions)*
21. Wireless Intelligent Network (WIN)	Subsection 6.2 *(Rearranged into Services Issues)*
XX. DPC Assignment *(not included)*	Subsection 1.7 *(Added as a new issue)*

INTERNATIONAL ROAMING GUIDE

Version 4.2 **September, 2001**

International Roaming Guide

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Disclaimer

This Guide is informational in nature. It is intended to provide guidance to international roaming service providers regarding issues related to and aspects of international roaming implementation. The information contained herein should not be construed as implementation recommendations or mandates. Service Providers should use and adapt the information to suit their unique telecommunications environment.

The International Forum on ANSI-41 Standards Technology (IFAST), as the authoring entity, disclaims any legal responsibility for the implementation of the information contained in the Guide.

Revision History

Revision	Description	Date
1.0	**Initial Draft Release**	**1/8/1999**
2.0	**Enhanced Draft Release**	**6/15/1999**
3.0	**Enhanced Draft Release**	**1/24/2001**
4.0	**Enhanced Draft Release**	**4/1/2001**
4.1	**Additional editing by Syed Hosain and David Crowe**	**5/2/2001**
4.X	**Revision by Watson Zan of Rogers Wireless Inc**	**9/12/2001**

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I. INTRODUCTION

The definition of International Roaming within the ANSI-41 (TIA/EIA-41) environment is fairly complicated because international roaming within countries that adopt the North American Numbering Plan (for example, roaming between Canada and the United States) is not an issue. Unlike the GSM (Global System for Mobile Communications) standard, the ANSI-41 standard was not originally intended to support international roaming; and did not take into account conflicts with numbering plans and/or routing schemes in other countries in the world that utilize ANSI-41 protocol (particularly those in South America, and the Asia/Pacific Rim region).

In the past, most of the problems concerning international roaming are related to numbering assignment and different dialing plans. Recently, many of the other issues influencing carriers' ability to support international roaming have also been identified.

So far, IFAST is the only industry organization who has been actively involved in trying to resolve the international roaming conflicts. IFAST members have been working diligently and exercising extra efforts to facilitate ways of supporting international roaming for other countries, and to resolve many related issues on a consensus basis. A typical example of such efforts is assignment of IRMs and SIDs that has enabled many carriers to realize the benefits of international roaming and motivated others to find more efficient and reliable ways to enhance international roaming.

During the IFAST-9 meeting, members recognized the need for a set of recommendations and guidelines that will help carriers interested in providing international roaming to their subscribers become more knowledgeable about the issues/problems and efficient to resolve them. This document provides such a set of recommendations and guidelines. The primary purpose of this document is therefore to provide all carriers globe-wide based on ANSI-41 standard with a description of some of the issues/problems relating to international roaming. Consequently, by the use of this document, it is hoped that the lessons learned and input from various carriers who deal with these issues/problems may help carriers benefit from each other's experiences, and find common approaches or solutions to most of the challenges facing international roaming implementation.

This document is intended to describe some of the issues, challenges and concerns related to International Roaming, and where possible, suggest how carriers deal with them effectively. In addition, this document can serve as a guideline for carriers who wish to implement International Roaming. However, it should be noted and emphasized that this document is not intended to serve as a standard or to provide a process for implementing International Roaming. Ideally, the need for this document will diminish as standards for supporting international roaming evolve and once carriers have implemented them.

The issues covered in this International Roaming Guide can be classified into the following main categories:

- Numbering Issues
- Dialing Issues
- Fraud Issues
- Billing Issues
- Signaling Issues
- Services Issues
- Miscellaneous Issues

Any new issues to be identified in the future may either be included in the above category, or in a new category if so deemed necessary.

II. ISSUES

1.0 Numbering Issues

1.1 International Roaming MIN (IRM) Assignment

1.1.1 Description

MIN (Mobile Identification Number) is a number to identify a wireless subscriber or mobile terminal. The numbers are assigned to every mobile in a network, or to any newly programmed mobiles. However, today there are international roaming networks that may have a MIN range conflict with the original MIN assigned to the roaming subscribers. For example, a MIN assigned to a subscriber from Washington, DC (2022441234) in the US may look like a MIN assigned to a Brazilian subscriber. When the US subscriber roams into Brazil, he/she will not be able to register with this MIN on the Brazil network due to the MIN conflict. To overcome this problem, a unique MIN must be assigned to the international roamer, which is not in conflict with any other MIN range. This MIN may be stored in a separate NAM and used only for roaming, or may be assigned as the primary MIN for the mobile.

1.1.2 Resolution

An International Roaming MIN (IRM) is such a unique MIN in the format of 0-XXX+6D or 1-XXX+6D, where X is between 0 and 9. IRMs are non-NANP MINs assigned to uniquely identify a range for each carrier interested in providing international roaming capability, and these uniquely identifiable blocks of 1 million numbers can be each assigned to a carrier anywhere globe-wide.

Currently, the International Forum on ANSI-41 Standards Technology (IFAST) is responsible for assigning the 4-digit IRM prefixes (0-XXX or 1-XXX) to a carrier and the assigned carrier allocates the last 6 digits based on its requirement. When assigning blocks of IRMs, IFAST tries to make sure that these numbers are not used by any other entity or applications that may conflict with international roaming, and posts the latest assignments on its Web site (www.ifast.org/irm.html) for public viewing. However, IFAST does not have the intent or the means to enforce compliance; rather, it encourages carriers and other interested entities to follow its guidelines with full cooperation, and to solicit their governments to ensure that MINs assigned locally or internationally do not conflict with the IRMs assigned by IFAST.

1.1.3 Recommendation

To date more than half of the IRMs have been assigned at a rate much faster than expected, and some numbering conflicts are already beginning to appear, although many have been resolved. Carriers must recognize that IRMs are a short-term solution to a long-term problem, and should try to define and implement other global standards such as IMSI and GTT for international roaming.

1.2 MIN/MDN Separation

1.2.1 Description

The MIN (Mobile Identity Number) and Mobile Directory Number (MDN) are programmed with the same value, or two closely related values. This simplifies the management of MIN codes. However, as a result of FCC mandate, all the wireless carriers in the US must implement Wireless Number Portability (WNP) by 24 of November, 2002. The greatest impact of WNP would be the separation of the MDN from the MIN. The separation of the MDN and MIN is chosen as the method to retain the ability to identify the home service provider of a wireless subscriber while still enabling the MDN to be portable. All the wireless carriers who roam must do the MSID/MDN separation for WNP. Even non-porting wireless service providers whether they are outside the top 100 MSAs within the US or international must separate the MIN and the MDN to support roaming for porting wireless service providers inside the top 100 MSAs.

The potential roaming impacts are:

- Delivery of calling number/calling name, automatic callback, and callback number on E911 calls; and
- Generation of correct calling party number for toll billing by the inter-exchange carriers, billing records and various operator services.

On the other hand, MIN/MDN Separation has a number of benefits:

- More efficient use of numbering resources
- Allocation of larger sized blocks of numbers
- Removal of constraints imposed by numbering plan
- Avoidance of MIN reprogramming when numbering changes occur.
- Smaller roamer agreement tables

1.2.2 Resolution

MIN/MDN separation requires wireless carrier to :

- Update the billing systems to ensure that they consistently and correctly use either the MIN or MDN.
- Identify mobiles via the MDN and not the MIN to emergency services or long distance companies
- Allow roamer ports to use the MDN and not the MIN.
- Upgrade the databases and switches to support both the MDN and the MIN.

The US wireless industry is currently implementing MIN/MDN separation through the creation of an MBI assignment authority, and will perform inter-carrier testing starting October, 2001 in accordance with the industry recommended test plans.

1.2.3 Recommendation

An Operations Team should be formed as soon as possible to implement the necessary upgrades and/or modifications to the network elements, message processing system, billing records and customer care facilities as recommended by the industry, and perform the internal testing upon completion of the implementation. This Team should also coordinate with roaming partners to conduct the inter-carrier testing in accordance with a mutually agreeable test plan.

It should be noted that the use of the IRM does not force MIN/MDN separation, as it may still be possible to derive one number from the other by deleting and prefixing digits. However, the use of the IRM may allow an opportunity to introduce this separation while network changes are being made.

1.3 SID Assignment

1.3.1 Description

A SID is a 15 bit (0-32,767) System Identity Number that is transmitted by a base station to uniquely identify a wireless license. The range of 32,768 through 65,535 is reserved to be used on the network for the different purpose such as a Billing ID (BID), and is therefore not available for use on the radio interface.

SID numbers are allocated to most countries in accordance with the guidelines provided in the TIA Standards TSB-29. However, there are SIDs, that have been in use, are not within the assigned block, thus creating SID conflicts, some of which have been reported to the IFAST community.

1.3.2 Resolution

The International Forum on ANSI-41 Standards Technology (IFAST) is currently responsible for the posting the latest assignments of SIDs and all known SID conflicts on its web site (http://www.ifast.org/SID/SIDtable.htm). It is imperative that carriers and regulatory agencies cooperate and comply with IFAST assignments, and report conflicts.

1.3.3 Recommendation

IFAST is attempting to accumulate information on the actual usage of SID blocks around the world. If there is information on the usage of SID codes in any country, or by any other entity, the IFAST Secretariat (ATIS) should be contacted immediately by using the contact information given at the end of this document.

1.4 International TLDN

1.4.1 Description

A Temporary Local Directory Number (TLDN) is a temporary number used to route calls to a roamer on a visited ANSI-41 system. As the name implies, this directory number is local (up to 10 digits in the North American Dialing Plan) in nature. As ANSI-41 standards were originally developed to support the North American Dialing Plan, only 10 digit TLDNs had been allowed in the early implementation of protocols. The TLDNs as currently implemented in the wireless network do not include a country code, thereby making a TLDN unable to dial international numbers. However, systems that support the International TLDN cannot successfully transmit this format to a system that does not support it, but must use the National TLDN format instead. Some systems have supported international roaming by using the National TLDN format through regional agreements and special conversion These techniques proved useful when used on a small scale. As the number of roaming partners increases, they become less practical.

1.4.2 Resolution

As ANSI-41 continues to grow and cross boundaries, the need for up to 15 digits TLDN to accommodate the Country Code (CC) is becoming apparent. ANSI-41 Rev. D calls for the implementation of a International TLDN, that contains a Nature of Number parameter which distinguishes between national and international formats.

The International TLDN will provide the following benefits:

- To distinguish between a TLDN of national and international format.
- To provide an international unique TLDN between two countries with different numbering plan administration.
- To ensure call delivery in an international roaming environment.

The implementation of an international TLDN requires that the visited network populate the TLDN parameter with the Nature of Number field set to Value 1 corresponding “international” and the TLDN must be in E.164 format, while the home network must recognize also the E.164 format and has the capability to check the Nature of Number field in order to route the call. Hence, prior to implementing TLDN, ANSI-41D features and capabilities must be in place.

1.4.3 Recommendation

The resolution to implement an International TLDN up to 15 digits by activation of the ANSI-41D parameter in the wireless networks was agreed at the IFAST14 meeting in Lima, Peru.

It should be noted that IS-41 Revision C was published with the Nature of Number parameter incorrectly specified as Value 0 for International and 1 for National. Carriers should ensure that only the ANSI-41-D encoding of this parameter field is used.

1.5 IMSI Implementation

1.5.1 Description

The Mobile Identification Number (MIN) to identify a mobile subscriber/station was developed with only the North American Dialing Plan in mind, and was originally intended to be used in the United States and Canada. It does not have any provisions for distinguishing between countries, nor does it conform to any international numbering plans. Due to the MIN conflict and the fact that a 10 digit MIN cannot provide the necessary information needed to facilitate International Roaming on a global scale, a better Mobile Identifier is becoming increasingly important. IMSI (International Mobile Station Identity) has been considered such Mobile Identifier.

1.5.2 Resolution

IMSI is a 15-digit number defined by ITU recommendation E.212. It has a 3 digit Mobile Country Code (MCC) that is assigned to a single country, and a 1-3 digit Mobile Network Code (MNC) that is unique to a carrier in that country. The IMSI functionality has been used and proved effective in the GSM world. IMSI has always been supported by GSM standards. It is currently supported by CDMA standards from IS-95 Revision A, TDMA standards from IS-136 Revision A and for intersystem operations if the recommendations of IS-751 are incorporated in a TIA/EIA-41-D system. However, IMSI is not supported in any analog standards.

In the US, a special IMSI format (310+00+MIN, where 310 is the MCC) so-called MIN-based IMSI has been defined considering the backward compatibility. Although the concept of the MIN-based IMSI is useful in other countries, it is not possible to universally designate “00” as the IMSI_11_12 (first 2 digits of MNC) for the MIN-based IMSI for all the MCCs since the MNC numbering plan is a national matter. If this technique is not universally supported, when a mobile terminal with the MIN-based IMSI sends a registration request to the HLR, the HLR may not be able to recognize the ANSI-41 IMSI parameter and the registration could fail. A list of MIN-based IMSIs should be shared among roaming partners and programmed in their MSCs to solve this problem.

1.5.3 Recommendation

Currently, although IMSI is considered an ideal long-term solution, because of lack of support in the analog systems and incorrect implementation in some early digital mobiles, it is unlikely that IMSI will be implemented in the immediate future. However, as the demand for international roaming increases and availability of IRMs decreases, carriers may be forced to implement IMSI as the only viable alternative to the MIN problem. Further, since the MNC numbering plan is a national matter, the value of the IMSI_11_12 of the MIN-based IMSI is determined country by country. It is recommended that the values be reported to the IFAST if the MIN-based IMSI is used, and that the digits “00” be used for the MNC if allowed by the national IMSI numbering plan.

1.6 MSC Identity

1.6.1 Description

The identity of the MSC/VLR is registered at the HLR during the location registration procedure and used to send a message asking for the TLDN. Three parameters, PC_SSN, MSCID, and MSCIN (MSCIdentificationNumber) are defined for this purpose in the ANSI-41. There were uncertainty and confusion as to how these three parameters should be used within an International Roaming environment.

1.6.2 Resolution

The PC/SSN should not be used for international roaming because the numbering plan of the PC/SSN is a national matter, while the MSCID includes the market ID field whose value is usually the SID, and the MSCIN is an E.212 number (IMSI). The MSCID is a mandatory parameter in the REGNOT and the MSCIN is optional. However, either the MSCID or the MSCIN can be used to identify MSC for international roaming.

Should MSCID be used, a lower layer signaling conversion function may be required in case where the lower layer protocol (e.g., Mobile Transfer Point - MTP) is different, by for example, maintaining a conversion table between ANSI PC and ITU-T PC. This table must be designed efficiently such as in the way of the cluster entry. If the MSCIN were used, SCCP GTT should also be supported. The introduction of the SCCP GTT has a big impact on the system, requiring extensive international coordination and therefore the use of MSCIN should only be considered as a long-term solution.

1.6.3 Recommendation

The MSCID be used as the identity of MSC in short-term, and the MSCIN for a long-term solution.

1.7 DPC Assignment

1.7.1 Description

To address SS7 messages, IS-41 protocol uses ANSI formatted Destination Point Codes (DPCs) for routing of the call to the final destination. These codes are assigned in accordance with the ANSI SS7 Point Code Assignment Guidelines, which are developed and maintained by Committee T1. The addressing to establish mobility interconnection between NANPA (North America Numbering Plan Area) based operators and other countries' operators also utilizes ANSI DPCs. Currently, since the ANSI DPC's are not assigned to the other countries' operators, the NANPA based operators have to assign a portion of their DPCs to their roaming partners in other countries for call routing during their contract period. If those operators in other countries want to change roaming/interconnecting partners, they are required to change the DPC's that they are using. A change of DPCs is a very significant task that involves changes in every switch of all the roaming partners at the same time. Most operators find it onerous to have to change signaling addresses throughout their networks, every time when they need to change their roaming partners. It is their contention that all the operators should be able to choose freely the roaming partners who best meet their business requirements, without the constraints of DPC control and the threat of an inevitable change of DPCs. The fact that IS-41 is using DPCs in the ANSI format, instead of the international ITU format, imposes the use of ANSI conventions and assignment rules.

1.7.2 Resolution

The proposed IFAST solution is to allow DPCs to be assigned to the non-NANPA operators in other countries, and request that Committee T1 modify the SS7 Point Code Assignment Guidelines by allocating a block of Point Codes for such purpose. Unfortunately, the I FAST proposal results in an inefficient use of Point Code resources, as the system may require the assignment of one Point Code in every country that direct routing is required to, and will only provide an interim solution. The other feasible alternative would be implementation of the GTT (Global Title Translation) capability in the gateway switches. GTT is an indirect addressing method, - a function provided by the Signaling Connection Control Part (SCCP) specified in ANSI and ITU, where the addressing identity is placed in a field named Global Title. A Global Title is a virtual/logical indirect address that identifies a telecom resource and translated into a SS7 Point Code which is a numeric direct address to the destination or other intermediate node. Global Title Translations (GTT) eliminates the need for the originating nodes to determine where a message should be routed. Instead, the Signal Transfer Points (STPs) determine the routing based on the type of query and some identifying numbers like a subscriber's MIN, a MDN, or other type of number. The routing, based on Point Code, which is provided to the Destination Point Code (DPC) field based on analysis of the identity provided from the user part. There may need to be several Global Titles based on the same type of number for different purposes.

The TIA TR-45.2 subcommittee has developed a list of standards relevant to Global Titles for ANSI SS7 systems with related information on ITU SS7 Global Titles (Ref: IS-807 and TSB-29), and has expressed willingness to expand this list to include information on the Global Titles provided in other countries.

Global Title Translation provides the following tangible benefits:

- To decrease the costs of administering national/international Point Codes.
- Reduce the number of digits analyzed in SPs and STPs in the visited network, thereby increasing routing analysis performance in each involved node.
- To remove the administration of MIN/IMSI ranges and related information from visiting MSCs (Mobile Switching Centres) and VLRs (Visitor Location Registers).
- To use national unique Point Codes instead of coordinating Point Codes on international level, with each country maintaining its own Point Code administration.
- To simplify the interoperability between ANSI and ITU SS7 networks, as the identity used in the Global Title field is common to both signaling standards.
- Increase the robustness in the network, since any changes to co-operating networks will not impact the home network.

1.7.3 Recommendation

IFAST has made a contribution to the appropriate Subcommittee within Committee T1 (T1S1.3) that proposes and requests modification of the current Point Code assignment rules so that operators in other countries are entitled to have unique DPC's assigned to themselves in order to provide international roaming services with the NANPA based operators in a fair and competitive environment. However, it is expected that to obtain Committee T1 agreement to or approval of the proposal would be a long process, and any assignment procedures to be developed, whether they are new or modified, could be tedious and contentious. There is a need for another feasible alternative, particularly in view of the long-term implication and rapid expansion of international roaming on a global basis. Implementation of the GTT capability in the gateway switch would be the only long-term alternate solution that should be considered.

The implementation of GTT requires that the following conditions are met:

- Compliance according to standards as listed below
  - ANSI-41D Cellular Radiotelecommunications Intersystem
  - IS-807 TIA/EIA-41D International
  - ANSI T1.112 Signaling System No.7, SCCP Functional Description

- The signaling network nodes such as MSC/VLR, HLR (Home Location Register), MC (Message Centre) and STP/International Gateways must have GTT capability

2.0 Dialing Issues

2.1 Uniform Dialing Plan

2.1.1 Description

A uniform dialing plan is needed to support services needed by subscribers while roaming. These services include:

- Local Customer Service
- Home Customer Service
- Directory Assistance
- Emergency Calling
- Long Distance Operator

An issue to be noted is that routing should be, if possible, to a service that can speak the preferred language of the subscriber (as transmitted by ANSI-41).

2.1.2 Resolution

- *Describe how the issue would/should be resolved*

2.1.3 Recommendation

- *Make proposal on the implementation of the resolution described in the above subsection*

2.2 Emergency Number Dialing

2.2.1 Description

ANSI-41 is used in various countries where different languages are spoken, with a variety of dialing plans. International roamers are usually not aware of the required digits to dial or procedure to follow in order to reach an emergency operator in a foreign country. Being able to easily and consistently dial the correct emergency number while roaming is probably the most important safety feature needed in the ANSI-41 protocol.

2.2.2 Resolution

The are two possible solutions:

- Create a Global Emergency Number (probably not likely, although a technically simple solution).
- Use the "Emergency bit" on the radio interface (e.g. TIA/EIA-136) when either a special emergency function is selected or a sequence of digits recognized by the phone as an emergency call is dialed. This method works except in places where neither the home digits nor the emergency bits are supported.

2.2.3 Recommendation

- *Make proposal on the implementation of the resolution described in the above subsection*

2.3 Optimal Routing

2.3.1 Description

Terminating calls to roamers in foreign markets are more complicated and expensive than necessary, which involves routing the call to the home MSC and then to the serving MSC, since callers do not usually know where the mobile subscribers are. For example, if a caller from Brazil dials the number of a Mexican subscriber roaming in Brazil, the call must get to the Home MSC (Mexico) and then get routed to the serving market (Brazil) even if the caller and the called roamer are standing next to each other.

2.3.2 Resolution

Possible solutions include:

- Use of the roamer port (works only with mobile-to-mobile calls, and requires knowledge of the local roamer port number by callers).
- Redirection via ISUP or ANSI-41 solution by means of the Release-To-Pivot capability, in accordance with the national and international SS7 standards
- In-band signaling, as proposed for tandem-free operation

2.3.3 Recommendation

- *Make proposal on the implementation of the resolution described in the above subsection*

3.0 Signaling Issues

3.1 ANSI-41/IS-41 Backward Compatibility

3.1.1 Description

In order to ensure that operations between various levels of IS-41 are workable, any mixture of IS-41 Rev. A (including mandatory TSB-55), IS-41 Rev. B (including mandatory TSB-41), IS-41 Rev. C, TIA/EIA-41 Rev. D (ANSI-41-D) and, in future, TIA/EIA-41 Rev. E and so on, backward compatibility will be very essential in terms of maintaining service quality and cost control. Compatibility must support partial implementations, particularly of IS-41 Rev. C and later, since full implementations may not be possible.

3.1.2 Resolution

- *Describe how the issue would/should be resolved*

3.1.3 Recommendation

- *Make a proposal on the implementation of the resolution described in the above subsection*

3.2 SS7 Related Roaming Issue

(MIKE DOYLE IS THE CURRENT MENTOR FOR THIS ISSUE)

3.2.1 Description

- *Define what is the issue*
- *Explain why the issue has an impact on international roaming*

3.2.2 Resolution

- *Describe how the issue would/should be resolved*

3.2.3 Recommendation

- *Make proposal on the implementation of the resolution described in the above subsection*

3.3 ANI Compatibility

(RICARDO GOMEZ AND/OR BERNARDO MARTINEZ SHOULD PROVIDE TEXT FOR THIS SECTION)

3.3.1 Description

- *Define what is the issue*
- *Explain why the issue has an impact on international roaming*

3.3.2 Resolution

- *Describe how the issue would/should be resolved*

3.3.3 Recommendation

- *Make proposal on the implementation of the resolution described in the above subsection*

4.0 Fraud Issues

4.1 Description

Fraud has been one of the major obstacles to international roaming and is an expanding problem in the wireless industry. It would be difficult to grasp the full impact of fraud since operators do not consistently or uniformly track fraud losses. The Cellular Telecommunications Internet Association (CTIA) estimates fraud losses in North America in 1996 were $900M, or about 3.6% of industry revenues. Although fraud losses have been steadily declining, fraud still represents a serious threat globally.

Fraud has taken different forms and is continuously changing its nature. There are generally three types of Fraud:

- Cloning Fraud - Changing the ESN after every call (tumbling) has been largely replaced with cloning of the phones. Cloning fraud occurs when the identity of the mobile phone is stolen. When the mobile unit presents its identity to the network, a criminal scanning the airwaves can steal the phone's identification numbers, the ESN and mobile number, and then program them into another phone. When this cloned phone is used, the charges appear on the legitimate subscriber's bill.

- Subscription Fraud - Subscription Fraud is another type of wireless fraud, which occurs when a criminal uses fraudulently obtained customer information or a false identity to subscribe to wireless service without any intention of paying for service. True name subscription fraud occurs when a criminal steals a person's identity. GSM operators in Europe have suffered significant subscription fraud losses for years while enjoying protection against cloning fraud through the authentication capabilities inherent in their digital technology. In addition to subscription fraud, operators are experiencing hacking into their networks to obtain access to confidential information, such as MIN/ESN combinations. Many operators are unaware of where their weaknesses are and should perform external testing to determine their vulnerabilities.

- Employee or Reseller Agent fraud - Employee or Reseller Agent Fraud, is another area affecting operators and the one which does not lend itself to a technical solution. Selling MIN/ESN combinations to criminals is a tempting opportunity for some employees to capitalize on their access to valuable information. Operators can screen employees before hiring, implement access controls and increase internal security. This type of fraud is anticipated to increase, as technical fraud becomes a more difficult and costly type of fraud to perpetrate.

4.2 Resolution

Three Fraud control technologies are deployed today in combating cloning fraud, as described below:

- Roamer Verification - Roamer Verification and Reinstatement (RVR) systems intercept roamers and forward them to a customer service representative to verify their identity before allowing them to make calls. Subscribers may be required to set up a code to enter the network. The subscribers are then required to enter a Personal Identification Number (PIN) or voice print password to use the network in selected high fraud markets. The home operator generally pays for this service, although the cooperation of the serving operator is required. Many operators have implemented PINs in high fraud markets as a stopgap solution until authentication is deployed. However, cloners who capture both the MIN and the PIN from the airwaves using scanners and other devices have compromised PINs. Additionally, the set up and ongoing use of PIN is rather intrusive on the customer. Because of these issues, operators have demanded improved fraud prevention technology, which can be deployed with limited customer involvement.

- RF fingerprinting - RF fingerprinting is a technique in which each phone's unique signal fingerprint is matched with its ESN/MIN combination. This match is confirmed before each call is connected. This technology is extremely effective and transparent to the user, but expensive to implement, as special hardware must be installed at each cell site. The US government originally developed RF fingerprinting, and it has been primarily implemented in major U.S. markets by larger operators.

- Authentication – Authentication requires a specially equipped authentication-capable phone with an activated Authentication-Key (A-Key) and an authentication center (AC). When a call is made, the network challenges both the handset and the AC to perform independent calculations using an encrypted algorithm and shared secret data. The results must match in order for the user to be authenticated and service to be provided. This process is instantaneous and transparent to the user. Since only the answer is broadcast over the network, fraud criminals cannot steal the important authentication information. Most operators in the U.S. have successfully deployed this technology in more than half the major American markets. Although the number of authentication-capable phones is growing rapidly, the majority of subscribers still have phones that cannot be protected by authentication and it may take years to replace the embedded base.

4.3 Recommendation

Profiling systems address all types of fraud by providing visibility into what is happening on a carrier's network. These systems detect fraud and act as an early warning system. They monitor information from switch and billing systems, and compare actual usage against the parameters of a customer's usage profile. When usage falls outside these defined parameters, a case is flagged and assigned a severity level. A fraud analyst then investigates the case. The skill and experience of the analysts is a factor in the success of this method.

5.0 Billing Issues

5.1 Description

In order to reap the financial rewards that international roaming can deliver, an operator must have an efficient process in place for the exchange of roamer billing records, validation or editing of those records, and systems for calculating and reporting financial positions with its roaming partners. Other elements that are essential to inter-operator relationships include record conversion to the appropriate billing record format, wholesale and retail rating of records and ultimately financial settlement with the exchange of funds with roaming partners. Managing hundreds of roaming agreements with roaming partners in different countries and time zones that are potentially utilizing different billing record formats and operating on different settlement cycles poses a significant administrative problem for any operator interested in international roaming.

5.2 Resolution

5.2.1 Billing Standards

The TAP or Transferred Account Procedure is the roamer's billing standard used in GSM. The equivalent in the ANSI-41 is CIBER. The Transferred Account Data Interchange Group (TADIG) is responsible for the development and documentation of the TAP standard, which business strategy and direction is provided by the Billing and Accounting Rapporteur Group (BARG).

CIBER was developed to support:

- Separate air, toll and tax fields.
- Multiple market identifiers for one carrier via the use of Billing Identifiers (BIDs).
- The Data Clearinghouses as the Authorized Receipt Points (ARPs) for file and record level editing and validation, and provides certification thus eliminating the one-to-one billing testing done between GSM operators.
- A process that enabled the "batching" and return of invalid, unbillable records and the forwarding of "good" data.

TAP was originally designed for the European community, and later its use was expanded to other continents, when GSM was adopted in the United States. At that time, operators received a license for regional markets, therefore intra-country roaming was established. For a number of years, there were, at most, two to four providers in a country, therefore operators built or purchased their own billing systems and did not outsource to a billing vendor. Since operators had their own billing systems, data clearinghouses were initially used only for file validation and routing.

TAP was primarily developed to support:

- Inter-country level "international" roaming only–no market identifiers were created.
- Use of a currency equivalent called the SDR (Special Drawing Rights). Rules exist for how to apply the exchange rate of currency type to the SDR.
- International identifiers known as Public Land Mobile Network (PLMN) codes – comprised of a 3 character ITU customer ID. This number is distinct and separate from the customer phone number.
- One charge field with VAT taxes calculated as a percentage.
- Voice and data utilization.

There are multiple TAP standards in use. TAP 2+ is the de facto standard for most of the world, but some operators still use TAP 1 and TAP 2. North American GSM operators use NA-TAP2 (North American TAP2) which has BIDs and separate fields for air, toll and tax. Most operators rely on the data clearinghouses for the conversion of one version of the standard to another. Conversion 'between' TAP and CIBER is also done by data clearinghouses as well as by some billing vendors and operators. Over the last few years, the TADIG group, with approval of the BARG, has developed and adopted a robust editing process, and just recently completed work on a Record level reject and returns process. Lastly, they have frozen the specification for TAP 3, which utilizes the ASN.1 standard and included the use of BIDs and the separation of air, toll and tax. TAP 3 is expected to be in use industry-wide by March 31, 2000, and the Rejects and Returns process by September 30, 2000. *(THESE DATES HAVE PASSED. IS THERE NEW INFORMATION TO GO HERE?)* Although the standard for TAP 3 has been frozen, not all operators will adopt it, as GSM allows for bilateral agreement on use of a standard. Operators in countries that do not utilize the new fields may agree to continue exchanging TAP 2 or TAP 2+.

5.2.2 Record Conversion

One of the important challenges that carriers face is conversion of incompatible call data records. The TAP formats (TAP 1, TAP 2, TAP2+ and NA TAP 2) have differences with CIBER records. The following is a brief list of the major differences between CIBER and TAP record formats that could cause carriers/operators problems when attempting inter-standard roaming and record conversion. This matrix is very high level and not intended to be record translation type information. It only outlines some major differences between CIBER and TAP business functionality and data usage. For the purpose of this document, NA TAP 2 is a hybrid of CIBER and TAP 2. As a result, it contains enough information to be translatable to both CIBER and TAP 2 and is therefore not referenced in the matrix.

CIBER	TAP
Rejects and Returns process in place.	No Rejects and Returns process today.
On rejects, individual records or whole files can be rejected if failing edits.	If a file contains an error, the whole file is rejected. Individual records in the file are not rejected, although this is changing. Some operators are now doing record-level rejecting, but there is no process in place to return rejected records to the submitting operator.
The industry settlement period is mid-month at the 15th of the month.	The industry settlement period is at the end of the calendar month.
Uses 10 digit MIN to identify subscriber.	Uses 15 digit IMSI to identify subscriber. Used similar to an account number. MSISDN is the actual dialable number of the subscriber.
Able to separate air and toll charges and to specify multiple types of taxes.	Only 1 charge filed so separation of charges is not possible. Also, there are not multiple tax fields. (A new record has been defined to provide a breakout of toll charges, but it is not currently being used and probably will not be used in the future.)
All charges on records indicate an actual dollar amount.	All charges are in SDR's (Special Drawing Rights) and require conversion to the country's currency. Also, negative charges (credits) cannot be handled.
Time duration fields on the records are reported in minutes and seconds.	Time duration fields are reported in seconds only.
US carriers rely heavily on SID/BID information in reporting and segmenting of their markets.	SID/BID does not exist. The PLMN or Operator code is the lowest level of distinction. Although MSCID is on records and could be used as a distinction for reporting, the MSCIDs don't necessarily denote geographic areas. Some operators set up their MSCs by criteria other than geographical location.
Time zones are indicated by a Time Zone Indicator.	Time zones are indicated by a UTC Time Offset (difference between local time and Greenwich Mean Time).

5.3 Recommendation

The integration of an operator's own in-house expertise with services offered by wireless billing vendors and data clearinghouses as described below will provide a solution to the above issues.

- Authorized Receipt Point, Rating and Conversion -

  Automated services offered by billing vendors and some data clearinghouses can often receive and convert switch data to standard billing formats including CIBER and TAP 1, TAP 2, TAP 2+ and NA TAP 2. The clearinghouse acts as the ARP for the home operator in processing the billing records in the appropriate formats and if needed for inter-standard roaming, converts them to a different version used by the roaming partner. In the multiple clearinghouse scenario, clearinghouses work closely together to exchange and reconcile data between themselves for their member operators. Today, five or so major clearinghouses serve wireless operators worldwide. The major clearinghouses should operate within mutually agreed-to processes enabling them to inter-operate smoothly on behalf of their member operators who roam together; operators do not need to have the same clearinghouse in order to have roaming arrangements with each other.

- Validating or Editing -

  An important element of the clearinghouse function is editing or validation of records, providing additional revenue assurance for the member operator. The clearinghouse reviews data to ensure it meets all CIBER or TAP standards and provides a "clean data stream" for further processing and for use in reports that assist in the management and operation of roamer business. Most clearinghouses perform industry standard edits, some also perform other more specific edits–an example being roaming agreement edits. Additionally, most clearinghouses edit or validate at both the record level and the file level. File level edits cause the entire file or batch of call records to be rejected. Conversely, record level editing allows for individual records to be edited and rejected from the file and for the rest of the records to be processed. Records that fail the validation process are sent back to the operator who submitted the data for correction and re-submission. The clearinghouse will also generate reports that provide information related to any files or records that have failed the validation and editing process for the operator to use for trouble-shooting and problem resolution.

- Reporting -

  The clearinghouse is in the position to provide valuable reporting on roaming trends and revenues for management to effectively manage their roaming business. In its processing cycle, the clearinghouse provides operators with important reports used for financial analysis by consolidating all accounts receivable, accounts payable, reject returns and analytical report data electronically. This process allows operators to closely monitor their roaming activity on a daily basis. The clearinghouse also provides data processing reports that typically go to the billing vendor of the operator. These daily reports provide information which, if properly monitored and acted upon, can mean the difference between an efficiently run, profitable roamer business or one that is at risk, victimized by operational problems and fraudulent roaming. During the processing cycle the clearinghouse forwards records to the billing vendor for re-rating for subscriber billing. At the end of the settlement period, the clearinghouse performs its monthly processing and along with the monthly financial and analytical standard reports that are provided to the operators, it provides financial settlement information used by its own financial net settlement program. The clearinghouse also provides the reports that can be used by the operator for accounts receivable billing or that can be forwarded onto another financial settlement program.

Today, most operators use a clearinghouse and/or billing vendor instead of setting up the exchange, rating, conversion and reporting of billing information themselves. Roaming partners using the same billing format don't experience the same strain on resources that inter-standard roaming can pose, but with the advent of satellite roaming and other newer technologies, the number of potential formats is increasing. Roaming agreements and settling roaming revenues between operators will become more complicated as international and inter-standard roaming grows. In terms of technologies, for example, CDMA operators won't necessarily restrict their roaming agreements to other CDMA operators and GSM operators are growing their scope to include roaming in TDMA markets today.

6.0 Services Issues

6.1 Support of Supplementary Services

6.1.1 Description

6.1.1.1 Activation and Deactivation of Supplementary Services

In general, Activation and Deactivation of Supplementary Services occurs when a mobile subscriber originates a call and enters digits that consist of a feature code string. The serving network receives the digits, analyzes the digits and triggers an ANSI-41 Feature Request or Origination Request operation to the HLR in the roaming subscriber's home network. Since the HLR in the home network receives the feature code string regardless of whether the subscriber is at home or roaming, the corresponding feature activation/deactivation is not affected by the subscriber's location. ANSI-41 allows the home network to specify that the serving network play announcement(s) or tone(s) to the mobile subscriber upon completion of the feature activation/deactivation call. The announcement(s) or tone(s) indicate whether the feature activation/deactivation attempt was successful. They can either be standard or custom announcements or tones. Clearly, custom announcements should be avoided since there is little chance that the custom announcement specified is available in the visited network. Standard announcements or tones are preferred over custom announcements, although in the former case, the standard announcement played to the mobile subscriber may be in a foreign language, leading to the possibility that the subscriber may not know whether the activation/deactivation attempt was successful.

6.1.1.2 Invocation of Supplementary Services

Invocation is generally Supplementary Service specific. The invocation can occur in the home network or occur in the visited foreign network. A home network example is invocation of the Call Forwarding Unconditional (CFU) feature. When a subscriber is roaming in a foreign network and has CFU activated, mobile termination attempts to that subscriber first arrive in the home network and are then forwarded to a previously registered forward number. The process of forwarding the call occurs in the home network. The visited foreign network is generally not involved in the mobile termination attempt.[1] A visited foreign network example is invocation of the Call Forwarding-No Answer (CFNA) feature. Here, the serving network needs to be aware that it should notify the home network when the subscriber fails to answer an incoming call. Specifically, the visited foreign network needs to know when to trigger an ANSI-41 Redirection Request message to the originating MSC in the home network.

[1] An exception could occur if both the home and visited networks support notification (e.g., pip tone alert) when a call has been forwarded.

6.1.2 Resolution

6.1.2.1 Activation and Deactivation of Supplementary Services

A general recommendation is to use tones to signal success or failure of feature activation/deactivation attempts, particularly while roaming internationally. A possible alternative is to use standard announcements when the ANSI-41 PreferredLanguageIndicator capability is supported in both the home and visited networks.

6.1.2.2 Invocation of Supplementary Services

Foreign network support of ANSI-41 triggers, both originating triggers and terminating triggers, requires consideration when assessing which Supplementary Services to offer subscribers wishing to roam internationally. Determination of whether origination and termination triggers are supported and if supported, which triggers are supported are important questions to ask during such an assessment. Some of this will depend on which version of IS-41/ANSI-41 is supported. For example, IS-41 Revision B does not support the TerminationTrigger parameter and instead, the serving network may need to trigger on the Calling Features Indicator, which is less flexible than the termination trigger parameter.

6.1.3 Recommendation

Determining which Supplementary Services to offer to international roamers requires careful assessment of the international serving network's services when compared to the home network's services.

The following provides general guidelines to follow during this assessment:

- Determine whether the foreign serving network supports allof the candidate Supplementary Services being offered to home subscribers that will roam internationally.
- Determine how the foreign serving network will notify the home HLR when a feature code string has been dialed by an international roamer.
- Agree on the method of notifying the international roamer of the outcome of an Activation/Deactivation attempt. If an announcement will be played, determine if the announcement will be understood by the subscriber.
- When Supplementary Services are invoked, determine whether the invocation takes place in the home or visited foreign network. The Supplementary Services invoked in the visited foreign network will require additional assessment. Differences in operation between the home and visited foreign network need to be understood and communicated to the international roamers.

Activation, Deactivation and Invocation of Supplementary Services should ideally function the same for subscribers served in their home network and subscribers roaming internationally. When this is not possible, either the Supplementary Service operational differences should be clearly identified and communicated to the international roamers or the Supplementary Service(s) should not be offered while subscribers are roaming internationally.

6.2 Deployment of WIN (Wireless Intelligent Network) Services

6.2.1 Description

Wireless Intelligent Network (WIN) is based on an open industry standard that enables equipment from different suppliers to interoperate successfully, and allows automatic roaming between various networks. WIN standard is part of the ANSI-41 family of standards, that allows additions of capabilities to any existing ANSI-41-based network within an open vendor environment, to ensure full interoperability with third-party products and services.

During the past several years, the wireless industry has been actively developing WIN capabilities which can be overlaid onto an existing wireless network. Network operators will be able to add WIN capabilities to any ANSI-41 based wireless networks by upgrading switching systems, typically with software upgrades, and installing new network elements such as Service Control Points (SCPs), Service Nodes (SNs), or Intelligent Peripherals (IPs). Further deployment of WIN additional capabilities will allow operators to create and deploy value-added services and enhanced features rapidly and at low costs.

The SCP platform in the WIN architecture reuses the hardware and software components deployed in a building block approach to lower WIN investment requirements while measurably reducing service time to market. The platform is scalable to allow capacity additions and flexible enough to provide multiple applications to meet changing subscriber and market demands. Innovative WIN solutions can now be deployed for networks based on AMPS, Code Division Multiple Access (CDMA), or Time Division Multiple Access (TDMA) technology to satisfy 800 or 1900 MHz requirements.

Most of the current Wireless services are switch-based (eg Call Waiting), Home Location Register (HLR) based (eg Call Delivery, Call Forwarding), or built on specialized platforms (eg Short Message Service, Prepaid Charging). Any or all of these existing services, plus many new services, could be built on WIN platforms, when they are migrated to a SCP-based service logic. All of the specialized resources required to support advanced/value-added services can also be built on a stand-alone Intelligent Peripheral platform that allows the resources to be shared by all WIN services. This reduces the cost to the network operator as the costs of the resource are spread over more applications. Some of the resources that may be IP-based include announcement machines, speech recognition devices, store-and-forward equipment, or voice mail systems.

Essentially, the potential benefits of deploying a service based on WIN platforms are:

- New services can be created, implemented, tested, modified quickly;
- Seamless roaming can be provided at low costs;
- "Virtual Home Environment" can be offered in such that the customer experiences the same user interface in any market;
- Services can be tailored to small groups if desired.

It should be emphasized, however, that although the WIN will offer many benefits in terms of service offering, each of the service offerings must be assessed individually to determine whether WIN platforms or current technologies would be most suitable.

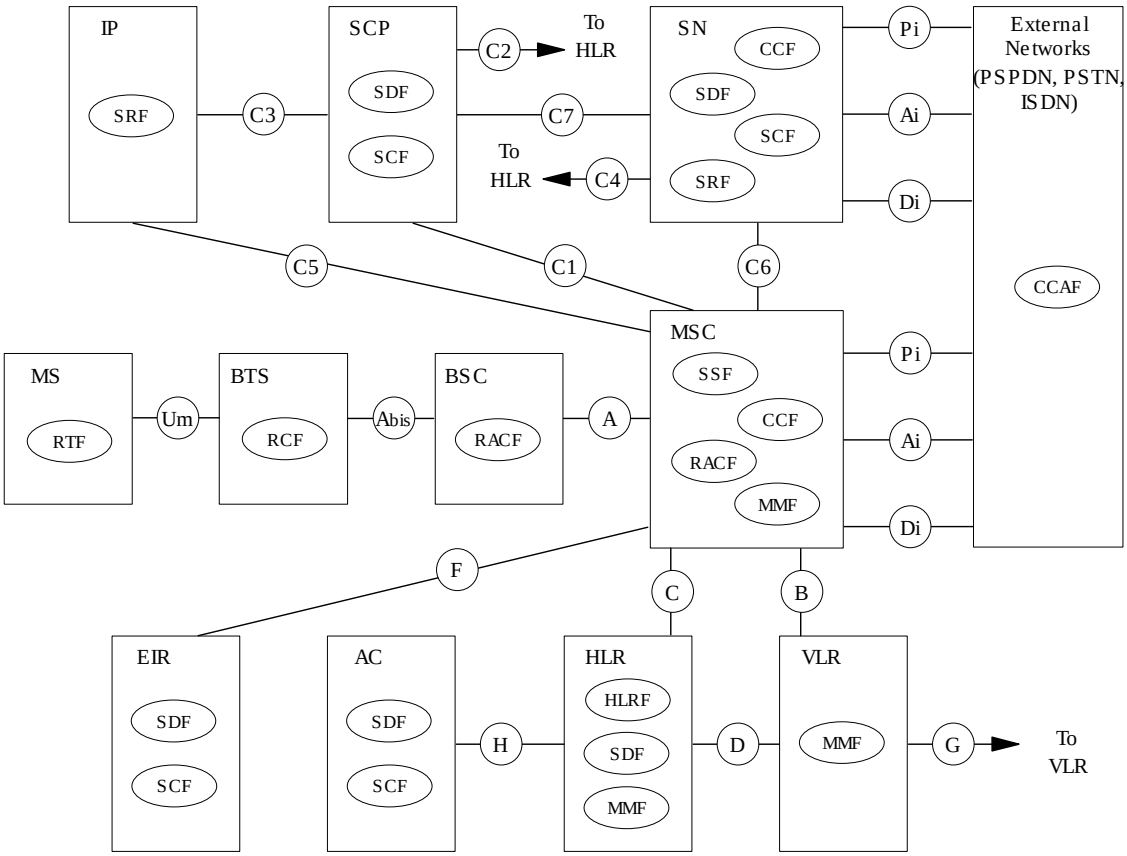
The WIN capabilities which have been developed so far are "service independent". The following provides a list of potential services using the WIN capabilities:

- Communication Management Services (CMS)
- Personal Numbering Services (aka Universal Access Numbers)
- Short Message Services (SMS)
- Traditional Intelligent Network Services
- Prepaid Services
- Wireless Group Conferencing Services
- Mobile Virtual Private Network (VPN) Services
- Information Messaging Services (IMS)
- Voice Recognition Services (VRS)
- Location Based Solutions Services

6.2.2 Resolution

6.2.2.1 Network Architecture

One of the most important aspects of the WIN architecture is to "map" the functional entities to the physical entities. Once the industry has reached consensus on this mapping, equipment designers will have more flexibility in developing the appropriate platforms. It will be much easier to make platforms from different suppliers to inter-operate, and to allow service developer to specify the location of the functional entities more precisely. The following Network Reference Model illustrates an industry's proposal of such mapping.



IP	Intelligent Peripheral	MS	Mobile Station
SCP	Service Control Point	BTS	Base Transceiver Station
SN	Service Node	BSC	Base Station Controller
PSTN	Public Switched Telephone Network	MSC	Mobile Switching Centre
		EIR	Equipment Identity Register
ISDN	Integrated Services Digital network	AC	Authentication Center
		HLR	Home Location Register
PSPDN	Public Switched Packet Data Network	VLR	Visitor Location Register

6.2.2.2 Call Process

In a WIN-capable network, the switching platform uses WIN call processing triggers and ANSI-41 messaging to access a range of SCPs, IPs or SNs based intelligent network services. This switch trigger approach allows optimum use of network resources while giving wireless subscribers access to the services that could previously only be provided with wireline intelligent networks.

The WIN triggers initiate an array of services based on call-related activities including billing, feature requests, origination, termination, mobile and registration, etc. Origination and termination triggers eliminate the need for subscribers to enter complicated feature codes and can provide simple access to abbreviated dialing, voice dialing and other enhanced features or advanced/value-added services. Termination triggers route callers to subscriber features such as incoming call screening, group ringing and distinctive ringing. Mobility-related triggers manage roaming, and mid-call triggers detect and confirm prepaid and other enhanced features or advanced/value-added services.

All calls are processed based on the standardized call models, called Basic Call State Model (BCSM). Inside the BCSM, Detection Points are defined to allow WIN service logic to control how a call is handled. Triggers are defined in the Detection Point in certain "point in call" for control transfer from the MSC to WIN service logic outside the MSC. Triggers can be defined for a single subscriber as well as a group of subscribers. Based on these capabilities, the WIN DFP provides distributed service control during call processing. Each subscriber can have a different set of triggers active, or service logic active for each subscriber, so WIN features can be incredibly flexible.

During call processing, when a trigger is armed and the condition is met, the MSC will stop processing the call and launch a query to the WIN service logic as defined in the WIN standards. The WIN service logic will process the request and instruct the MSC to continue call processing according to the instruction. The standards define a set of network capabilities based on service drivers. Capabilities developed for these service drivers can also be used to develop other WIN services.

6.2.2.3 Technical Standards

The engineering of WIN is a complex process, so the standards development work has been divided into large packages. Each package contains a set of service independent "triggers" and/or "capabilities", supporting a variety of services. Each network operator can then negotiate with its suppliers to develop the services as demanded by its local market.

The following three standards packages have been or are being developed by the TIA (Telecommunications Industry Association) TR-45 Engineering Committee:

- **Package 1 (WIN Phase I):** Defines the architecture, provides the first batch of triggers and capabilities for basic call origination and call termination, and supports services such as Calling Name Presentation, Incoming Call Screening and Voice Controlled services. The standards documentation has been published as TIA/EIA/IS-771.

- **Package 2 (WIN Phase II):** Adds the second batch of triggers and capabilities, and supports Charging Services such as Prepaid, Freephone, Premium Rate, and Advice of Charging. The standards documentation has been recommended for publication as TIA/EIA/IS-826 for Prepaid and 848 for other Charging Services.

- **Package 3 (WIN Phase III):** Adds the third batch of triggers and capabilities, and supports Location Based Services such as Location Based Charging, Fleet and Asset Management, Location Based Information Service, and Enhanced Calling Routing. The standard documentation is currently being under development and to be published as TIA/EIA/IS-843.

To support the above packages for inter-systems operations, the TIA TR-45 Engineering Committee has also completed and published the related standards documentation as per ANSI-41 Revision D. WIN has impact to many of the messages in IS-41D. The fields required vary depending on a specific WIN feature.

6.2.3 Recommendation

6.2.3.1 Implementation Strategy

Implementing WIN services in a wireless network requires:

1. Upgrade MSCs to support WIN triggers
2. Upgrade HLRs to support WIN triggers and service profiles
3. Deploy WIN service logic programs

The service logic programs may be deployed on the Compaq SCPs, or on Ericsson Jambalas, or both. Another path would be to deploy an SCP and service logic programs from another vendor entirely such as Lucent or Nortel.

There are some unique challenges to deploying WIN-based services. The key difference between WIN services and conventional switch-based or HLR-based services is the use of WIN triggers. Conventional services do not employ triggers. WIN services require that the MSCs be upgraded to support WIN triggers.

Once the WIN upgrades have been installed in the network, it will be necessary to test the network to ensure that the new services work properly, that existing services have not been negatively impacted, and that the existing infrastructure can handle the increased SS7 traffic. Additionally, operators will have to work with their roaming partners to make sure that roamers can access their WIN services as they roam between networks.

The following specific issues must be carefully addressed:

- **Interaction with existing services:** The new WIN capabilities will be built on the existing SS7/ANSI-41 signaling protocol, hence many of the existing ANSI-41operations may have to be modified to support these new WIN capabilities. As a result, the behaviour of existing services based on SS7/ANSI-41 signaling protocol may be affected when WIN is introduced into a network. Detailed information is provided in the appropriate TIA WIN standards.
- **Signaling traffic volume:** WIN will result in a higher signaling volume - more signaling to control the complex services and network elements - which will increase as subscriber usage increases. Operators will need to test them under the most extreme conditions to ensure that adding new services does not compromise reliability. It may be appropriate to invest in a test platform for WIN in order to simulate the operation of the WIN call models. A good testing platform will allow Engineering to explore scenarios using different call scenarios or unusually high call volumes, signaling link failures and other network variables.
- **Interoperability while roaming with partners:** The industry has developed technical standards for WIN so that the equipment designed will be in compliance to these standards, in order to ensure interoperability between equipment from different vendors, and also roaming between networks. Interoperability between the different types of equipment must be tested by network operators to ensure that they are compatible. This should be done on test platforms prior to deploying any WIN capabilities in the network.

  For “partner” subscribers, automatic roaming and service consistency will be more difficult to achieve because the partners networks may employ the types of MSCs different from those of the home system

There are three possible service creation options based on WIN platforms:

- **“Turn-key” solutions** provided by infrastructure suppliers using applications built for a particular platform. This approach will limit deploying only those services that this infrastructure supplier has developed.
- **“Off-the-shelf” solutions** offered by a variety of application developers, using applications developed for open platforms. This approach will provide as many services as they are commercially available, but more engineering and testing work as the burden will be required to perform interoperability testing between the switch and the application.

- **"Do It Yourself" solutions** based on the applications developed by operators using Service Creation Environment developed by software suppliers. This approach will allow creation of almost any services as demanded, however, there is a substantial learning curve involved for the designers, plus potential interoperability issues which may have to be resolved.

6.2.3.2 Installation Requirements

WIN installation affects the following network nodes:

- Mobile Switching Centers (MSC)
- Home Location Registers (HLR)
- Service Interaction Managers (SIM)
- Service Control Point (SCP) in support of the HLR and/or the SIM

WIN, in general, does not affect the mobile units. Some features (such as Calling Name Presentation) may require display capabilities on the mobile, but most features will not impact the handset.

MSC's and HLR's must be upgraded to allow the triggers to be downloaded to the switch during the registration process. The HLR may also act in the role of a SIM, so the SIM itself is optional. Flexible Service Logic Programs (FSLP's) will also be needed, but the interface between the SIM and the FSLP is not standardized, and so varies from vendor to vendor. It is also possible to have several SIM's in the same network offering different services. Each company will need to determine its needs and its engineering plans prior to installation. SIMs or HLRs acting as SIMs are generally fairly complicated systems in their own right, and should be studied well before installation. Contacting vendors early for training is highly suggested.

The main communications path for WIN and roaming partners is SS7. WIN will work as long as SS7 connectivity exists, however, Global Title Translation and use of the IMSI is highly suggested to simplify the long term support issues with roaming partners.

In general, WIN allows for a very quick reversal of the installation process by simply changing the user profile in the HLR. Additionally, WIN tends to reduce the need for new MSC and/or HLR loads since their action is always the same. New services require only a new FSLP (and perhaps a new SIM) to add this feature to the network.

The prerequisites required for WIN installation include**:** GTT, ANSI-41D, IS-771. IMSI is also suggested to assist with GTT and to simplify services.

7.0 Miscellaneous Issues

7.1 Roaming Agreement Modeling

(ADOLFO ACEVEDO SHOULD PROVIDE TEXT FOR THIS SECTION)

7.1.1 Description

- *Define what is the issue*
- *Explain why the issue has an impact on international roaming*

7.1.2 Resolution

- *Describe how the issue would/should be resolved*

7.1.3 Recommendation

- *Make proposal on the implementation of the resolution described in the above subsection*

7.2 Tandem Free Operation

7.2.1 Description

Operation of mobile-to-mobile calls without intermediate voice coders is desirable. This requires the use of compatible voice coders by both mobiles, in-band signaling to control the voice coder modes, the ability to switch intermediate voice coders in and out of the call path dynamically, and the absence of intermediate network components, such as echo cancellers.

7.2.2 Resolution

- *Describe how the issue would/should be resolved*

7.2.3 Recommendation

- *Make proposal on the implementation of the resolution described in the above subsection*

III. GLOSSARY

Category	Term	Abb'n	Definition
Billing Term	Billing Identifier	BID	A SID allocated for accounting purposes, and administered by CIBERNET Corp
	Cellular Inter-carrier Billing Exchange Record	CIBER	Tape format for wireless billing records. Maintained by CIBERNET Corp
Industry Association	Alliance for Telecommunications Industry Solutions	ATIS	
	Cellular Telecommunications Internet Association	CTIA	
	CIBERNET Corp		A subsidiary of the CTIA responsible for facilitating billing aspects of roaming
Network Element	Authentication Center	AC	Stores information for authenticating mobiles and encrypting their voice and data transmissions
	Base Station	BS	Includes BTS and BSC
	Base Station Controller	BSC	The 'brains' of a base station, controlling the radio equipment in the BTS
	Base Transceiver System	BTS	Radio portion of BS
	Equipment Identity Register	EIR	
	Global Title	GT	A non-native SS7 address based on E.164 DN's, E.212 IMSI, etc
	Global Title Translation	GTT	A method of routing in SS7 networks based on global titles and not Point Codes
	Home Location Register	HLR	
	Message Center	MC	See "Short Message Center"
	Mobile Station	MS	Wireless Phone
	Mobile Switching Centre	MSC	
	Service Node	SN	A combination of SCP and IP functionality.
	Service Switching Point	SSP	An MSC or other type of switch.

	Short Message Center	SMC	
	Short Message Service	SMS	
	Signaling Control Point	SCP	
	Signaling Transfer Point	STP	An SS7 packet router.
	Subscriber Identification Module	SIM	“Smart Card” for a GSM phone (See UIM)
	User Identification Module	UIM	“Smart Card.” See SIM.
	Visitor Location Register	VLR	
Numbering Term	Directory Number	DN	The number dialed to terminate a call to a phone.
	Electronic Serial Number	ESN	32 bit identifier of an AMPS mobile.
	International Mobile Equipment Identity	IMEI	
	International Mobile Subscriber Identity	IMSI	Formerly called International Mobile Station Identity. Based on the ITU-T E.212 numbering plan.
	International Roaming MIN	IRM	A MIN beginning with the digit 0/1 to uniquely identify a mobile that does not have a DN to avoid conflict with NANP MINs
	MIN Block Identifier	MBI	A 6 digit code used to identify a block of MIN codes within the NANP
	Mobile Country Code	MCC	3 digit number that is assigned to a single country. The first three digits of an E.212 IMSI
	Mobile Directory Number	MDN	A phone number (DN) assigned to a mobile
	Mobile Identification Number	MIN	10digit identifier of a mobile subscription. See IRM, MNC, E.212
	Mobile Network Code	MNC	Identifies an individual carrier, or a portion of a carrier network
	Mobile Station Identifier	MSID	Either a MIN or an IMSI
	North American Numbering Plan	NANP	
	Number Assignment Module	NAM	Storage for a single MIN/IMSI/both with related information to identify the subscription. A mobile may have multiple NAM’s for multiple subscriptions
	Originating Point Code	OPC	Where an SS7 message came from.
	Point Code	PC	A numeric SS7 address. 24 bits in the NANP, 16 bits in Japan, and 14 bits in most other countries

	Sub-system Number	SSN	Along with PC, identifies and SS7 network application or a virtual SS7 network entity
	System Identifier	SID	A 15 bit identifier of an AMPS wireless license or system
	Temporary Local Directory Number	TLDN	A number used for routing calls from the Home MSC to MSC-V
	Temporary Mobile Station Identity	TMSI	Used as a shorter, more private, mobile identifier. Identifies the system that assigned it and not the mobile directly
Standards Document	E.164		ITU-T dialing plan standard
	E.212		ITU-T Mobile Identification number standard
	IS-		TIA Interim Standard
	IS-124		Wireless call detail and billing record format for online transfer
	IS-136		Second generation TDMA air interface standard
	IS-2000		CDMA 2000 air interface standard
	IS-41		Wireless inter-systems operation standard. Now called TIA/EIA-41 or ANSI-41
	IS-634		A-interface standard between BS and MSC
	IS-91		Most advanced analog air interface standard (including NAMPS)
	IS-95		CDMA One CDMA air interface standard .
	J-STD		Joint ATIS-T1/TIA standard
	Project Number	PN	TIA Project Number
	Standards Proposal Number	SP-	ANSI Standards Proposal Number
	Telecommunications System Bulletin	TSB	TIA often uses it as an addendum or erratum to a published interim standard.
	TIA/EIA-124		Wireless call detail and billing record format for online transfer. Replaces IS-124
	TIA/EIA-136		Second generation TDMA air interface standard. Replaces IS-136
	TIA/EIA-41		Wireless intersystem operations standard. Previously called IS-41. Also known as ANSI-41

	TIA/EIA-95-B		Third generation CDMA air interface standard. Replaces IS-95
Standards Organization	American National Standards Institute	ANSI	
	Committee T1		ATIS standards committee
	Electronic Industry Alliance	EIA	
	International Telecommunications Union	ITU	
	International Telecommunications Union-Telecommunications Division	ITU-T	
	International Telecommunications Union-Radio Communications Division	ITU-R	
	Standard Development Organization	SDO	The TIA and ATIS are examples of SDOs
	Telecommunications Industry Association	TIA	
	TR-45		TIA Standards Committee responsible for AMPS-based cellular and PCS standards
	TR-45.1		TIA analog cellular standards subcommittee
	TR-45.2		TIA Standards Subcommittee responsible for intersystem protocols
	TR-45.3		TIA DMA digital cellular/PCS standards subcommittee
	TR-45.4		TIA BS/MSC “A” interface standards subcommittee
	TR-45.5		TIA CDMA digital cellular/PCS standards subcommittee
	TR-45.6		TIA CDPD standards subcommittee
Signaling Term	Common Channel Signaling System #7	CCS7	ITU-T version of SS7
	ISDN User Part	ISUP	SS7 call processing signaling between switches
	Message Application Part	MAP	Protocol that interconnects wireless telephone systems (eg., MSCs and HLRs)
	Message Transfer Part	MTP	SS7 transport layer

	Signaling Connection Control Part	SCCP	SS7 enhanced routing and identification layer
	Signaling Point	SP	
	Signaling System Number 7	SS7	Common channel telecommunications packet switching
	Transaction Capabilities Application Part	TCAP	Message packaging standard used by ANSI-41/IS-41 and defined in ANSI T1.114
Technical Term	Advanced Mobile Phone Service	AMPS	
	Calling Party Pays	CPP	The calling party pays for calls to mobile, not the mobile receiving the call
	Digital AMPS	D-AMPS	IS-54 and IS-136 TDMA
	Dual Tone Multi-frequency	DTMF	Tone signaling used by phones
	Global System for Mobile Communications	GSM	
	Invoke		Message sent to initiate an ANSI-41/IS-41 transaction
	Narrowband AMPS	NAMPS	
	Over-the-Air Programming	OTA	Uploads internal mobile tables.
	Personal Communications System	PCS	
	Public Land Mobile Network	PLMN	A cellular or PCS network.
	Public Switched Telephone Network	PSTN	Utilizing R1 MF tone interfaces.
	Time Division Multiple Access	TDMA	Modulation technique used by D-AMPS and GSM.
	Wireless Intelligent Network	WIN	Protocol with similar goals as IN and AIN.

Related Contact Information:

For more information on the IFAST, please contact the IFAST Secretariat:

Megan Hayes
ATIS
1200 G Street, NW, Suite 500
Washington, DC 20005
USA
Tel: +1-202-662-8653
Fax: +1-202-393-5453
Email: ehall@atis.org

For more information on IRMs, please contact the IRM Administrator:

David Crowe
Cellular Networking Perspectives
2636 Toronto Crescent NW
Calgary, AB, T2N 3W1, CANADA
Tel: +1-403-289-6609
Fax: +1-403-289-6658
Email: David.Crowe@cnp-wireless.com

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