INTERNET DRAFT
Category: Standards Track
Title: <draft-greene-ss7-arch-frame-00.txt>
Date: July 1998

Expires: January 1999

Fernando Cuervo
Nancy Greene
Nortel(Northern Telecom)
Matt Holdrege

Ascend Communications
Lyndon Ong
Bay Networks
Christian Huitema
Bellcore

SS7-Internet Interworking - Architectural Framework
<draft-greene-ss7-arch-frame-01.txt>

Status of this Memo

Abstract

This document describes an architectural framework for SS7-Internet interworking, onto which existing protocols and future protocols in this space can be mapped. It also provides an ordering of importance for the standardization of these protocols.

Table of Contents

1.0 Introduction

This architecture document covers subject terminology and defines at a high level a set of individual scenarios for SS7-Internet interworking. These scenarios include dial-up internet access, Voice over IP transit, and transport
of SS7 signaling over IP. It then proposes a series of steps for standardization.

2.0 Terminology

The following functions are commonly identified in related work [4,5]:

Call Controller:
A Call Controller introduces an open interface between a Signalling Gateway and a Signalling Agent/Media Gateway Controller, allowing the
Signalling Agent to access the SS7 network through multiple redundant interfaces, e.g. the classic "quad" configuration of SS7 networks. A Call Controller encompasses both a Signalling Agent and a Media Gateway Controller.

Media Gateway (MG):
A MG terminates PSTN facilities (trunks, loops), packetizes the media stream for
IP, if it is not already packetized, and delivers packetized traffic to the IP network. Examples of MGs are NAS (Network Access Servers) and VoIP gateways. The NAS and VoIP functions may or may not be combined in one gateway.

Media Gateway Controller (MC):
An MG handles the registration and management of resources at the MG. The MC
may have the ability to authorize resource usage based on local policy, for example, based on the attributes of both the end-user and the ISP. NAS Controllers [5], for instance, provide MC functionality.

Network Access Server (NAS) Controller:
A NAS Controller allocates and deallocates resources according to some resource
policy. A NAS Controller may control many NAS. It may share a server platform

with Authentication/Authorization/Accounting (AAA) server functions and/or
proxies to other AAA Servers. A NAS Controller encompasses both a Signalling

Gateway and a Media Gateway Controller.

Service Control Point (SCP):
This is a node in an SS7 network that provides centralized service logic and

data, such as call routing information.

Signal Transfer Point (STP):
This is a node in an SS7 network that routes signalling messages based on their
destination address in the SS7 network

Signalling Agent (SA):
An SA realizes the signalling mediation function within the IP network, for instance, for MG-to-MG, MG-to-SG, and SG-to-SG interworking. A "Call Agent" in [4] includes an instance of an SA.

Signalling Gateway (SG):
An SG is a signalling agent that receives/sends PSTN native signalling at the
edge of the IP network. The SG function may relay, translate or terminate SS7
signaling in an SS7-Internet Gateway.

Other Servers (OS):
Other servers provide address translations, feature information, authentication
services. IN-SCPs and RADIUS servers are instances of OS.

Depending on the document, the functions MG, MC, SA, SG and OS are grouped into
nodes such as an SS7 Gateway, NAS Controller, Call Controller, Call Agent, VoIP
gateway or NAS as discussed below.

3.0 Base Configurations

SS7-Internet interworking today covers dial-up access and VoIP applications.

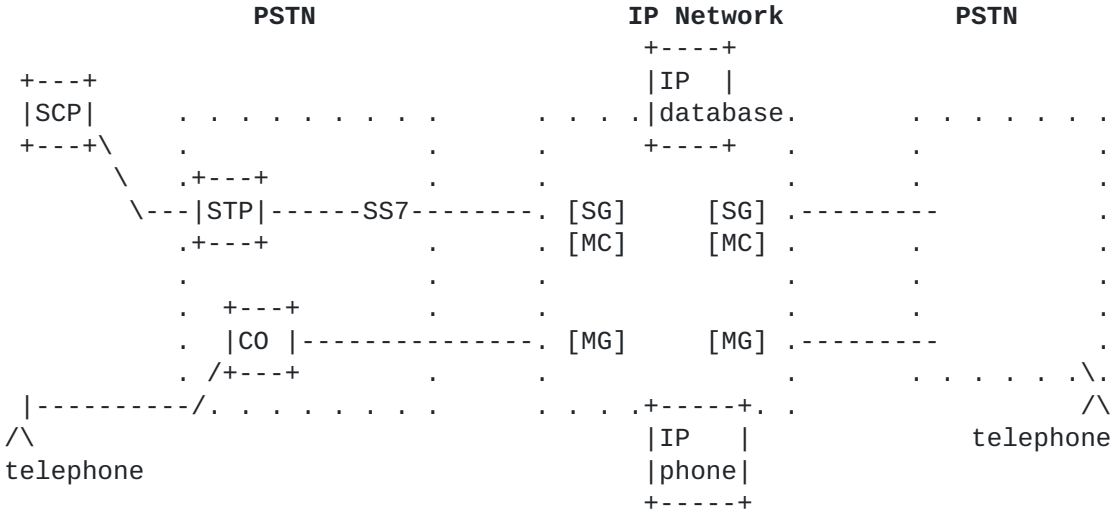
This section presents base configurations that serve to illustrate the open interfaces in the architecture, labeled by ----O----- in the figures below.

The figures also illustrate possible groupings of the functions enumerated above, and propose an ordering of importance for standardization of the protocols (the ordering of the figures implies an ordering of importance).

Currently several schemes are proposed for communication between a SG, MC, and
MG. To allow these different functions to be encompassed in boxes that can communicate even when the boxes are manufactured by different companies, standard protocols are required. The sooner this occurs, the better. Thus, the
highest priority of work should be to standardize the protocol for PSTN native
signalling between the SG and MC/MG functions (section 3.2). However, there are
other areas of work that may be addressed. These are covered in sections

3.3,
3.4 and 3.5.

3.1 A Reference Architecture



Notes:
- SG, MC, and MG are functions that can be arranged in many ways with the IP network. For example, [SG] and [MC] can be an SS7 gateway and/or NAS controller, co-located or separate, and [MC] on its own can be a call controller, and [MG] can be a Network Access Server (NAS) or VoIP Gateway
- IP database is any database accessible over IP
- CO is a central office, or PSTN switch,
- communication between MGs and SG/MCs may depend on whether the communication is for dial-up access or VoIP

Figure 1: Reference Architecture

Signaling System 7 (SS7) networking is the primary means used in the PSTN for control of circuit-switched connections and value added PSTN services such as freephone (800/888) number translation, calling card validation and Intelligent Network services. An architecture that includes a Signalling Gateway provides a scalable method of supporting interworking between SS7 network elements and Internet elements such as a Network Access Server (NAS), or media gateway. By accessing the telecom network with SS7, data network elements fit cleanly into the telecom network infrastructure as peer switches and control points and can exchange information with telecom network elements for cleaner routing and treatment of connections. [12, 13] provide more information on SS7.

The initial application of SS7 interconnection is to allow Internet access

points such as a media gateway to appear to the telecom network as a peer telecom switch, for purposes of terminating calls for dial-up Internet access.
Future applications include allowing exchange of information between more general nodes within PSTN and Internet, such as a PSTN SCP and an Internet telephony service (VoIP), or a PSTN switch and an Internet information server,
such as a directory.

3.2 Dial-up Access Configuration

3.2.1 SS7 Dial-Up Access Configuration

Figure 2 is a simplified description of an SS7 dial-up access configuration.

Details related to end-user authentication have been left out for the sake of
clarity.

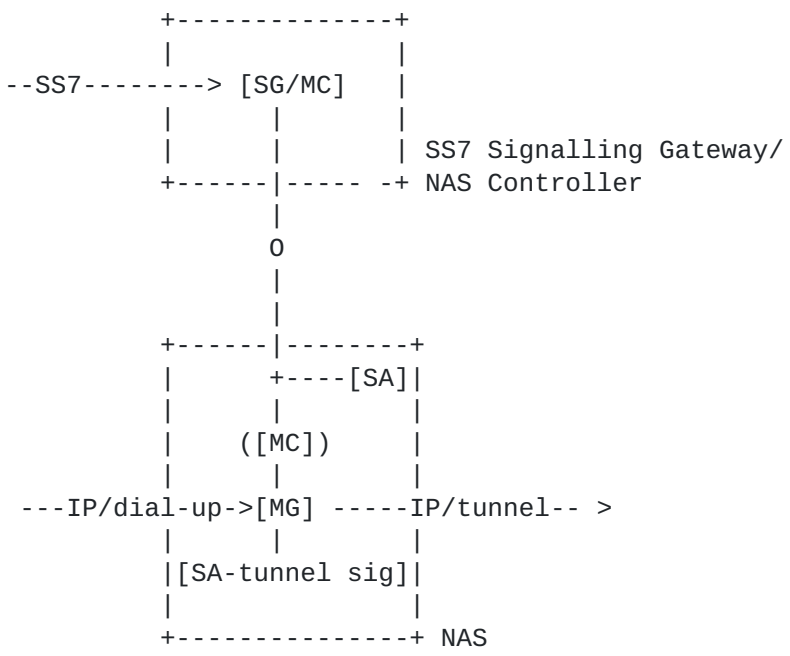


Figure 2: SS7 dial-up access configuration

The architecture in figure 2 has one open interface. Today, two alternatives for
this protocol are represented by products in the industry. On one hand, [1,2,3]
advocate an architecture in which some of the MC resource management function
resides in the NAS, and some MC functions such as registration reside in the

Signaling Gateway. [1,2,3] propose a Q.931-based protocol for the interface

between Signaling Gateway and NAS. On the other hand, [5] integrates the entire
MC function in the SG, and removes it from the MG. [5] proposes the use of

DIAMETER [6,7,8,9,10,11] extensions for the open interface.

A typical call flow for figure 2 would be the following. An SS7 message arrives at the SG/MC from the PSTN, initiating call setup. The SG/MC translates this into notification to the NAS SA of the call request and the trunk to be used for the incoming call. The NAS MG then terminates the media stream arriving on the trunk and packetizes the data for the IP network. The NAS determines the IP destination for the data, either through internal means or from information that the SG/MC provides.

3.2.2 Alternate Architecture for SS7 Dial-Up Access Configuration

An alternate architecture (figure 3) is to separate the NAS controller and Signalling Agent functions from the Signalling Gateway and to place them in a Call Controller.

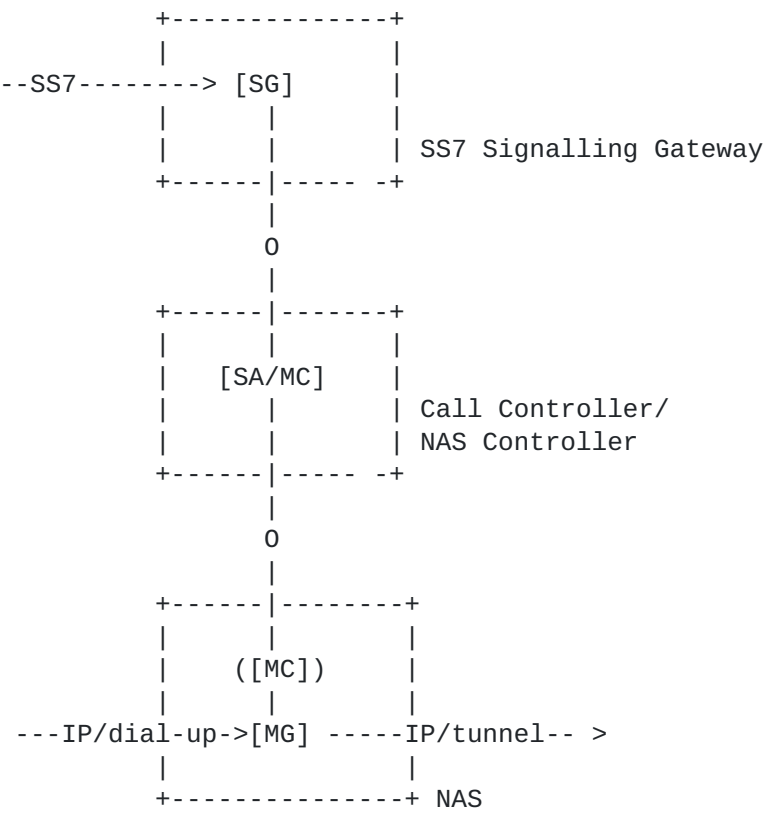


Figure 3: SS7 dial-up access configuration, with a separate call controller

This alternate architecture is assumed in [4]. It presents two open interfaces, one between the Signalling Gateway and the Call Controller, and a second one

between the Call Controller and the NAS. An open interface between SG and SA
allows an SA to access the SS7 network through multiple redundant interfaces,
e.g. the classic "quad" configurations of SS7 networks.

3.2.3 Comparing Approaches

While the highest priority of work should be to standardize the protocol for

PSTN native signalling between SG and MC/MG functions, discussion should take
into account the other functions in the architecture that are required to
provide working services. The three approaches identified above can be compared
as follows:

1- Q.931+ extensions [1,2,3] follow a standard protocol for call signalling messaging and add new messages for resource control, configuration, and SS7 maintenance procedures such as busying of trunks and channels, graceful and abrupt shutdown of trunks, and continuity testing.

2- Use of a protocol framework such as Diameter with resource control extensions
[6,7,8,9,10,11], or a similar suite of protocols [IPDC-TAC internet-draft - to be provided], adds generic support of other functions such as security, end-user authentication extensions, dynamic association of SG and MC to MGs,

etc.

3- Use of an open interface between SG and SA, based for example on some form of
transport of ISUP over IP, combined with the protocol proposed in [4], allows
to concentrate all call-state in a Call Controller, enables calls to survive

the failure of an individual SG, and provides for compatibility with VoIP solutions.

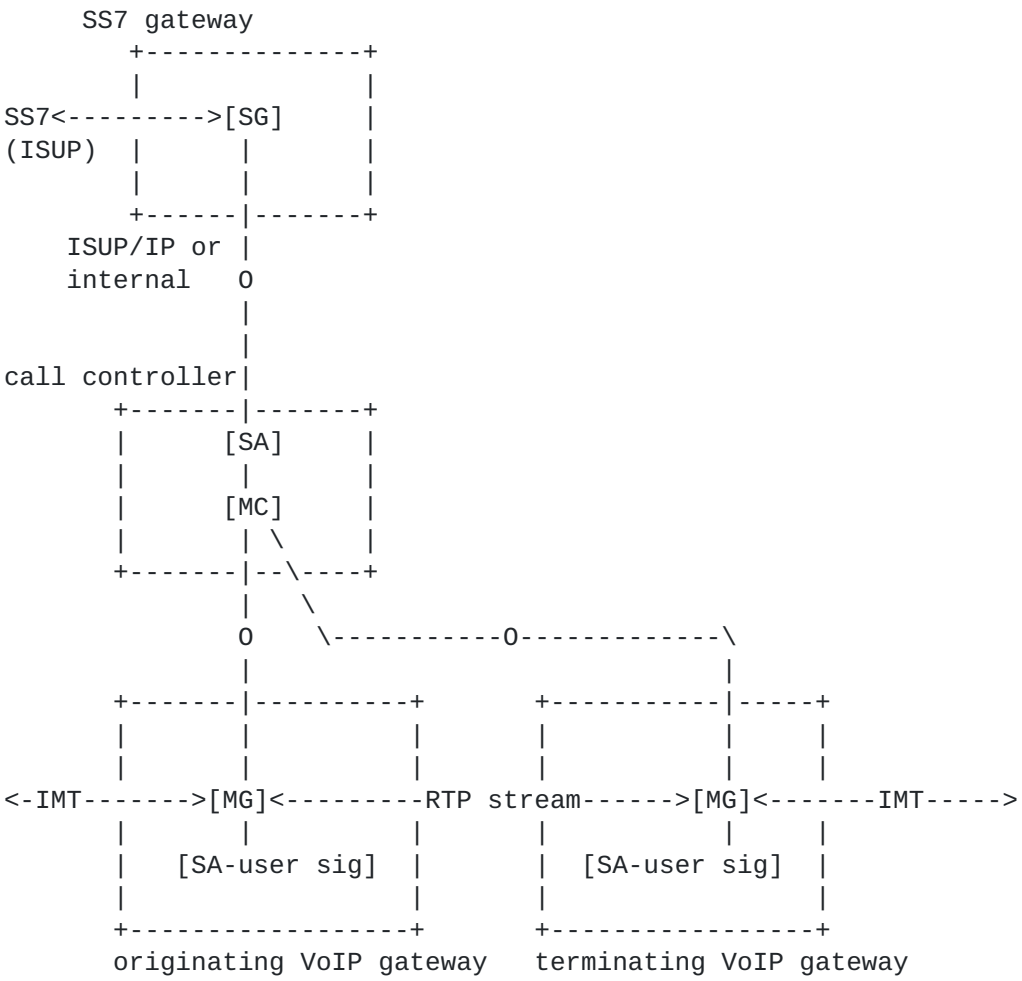
3.3 VoIP Transit Configuration

VoIP transit adds new requirements to the architecture. For example, there will
be more than one VoIP gateway involved in a call, and possibly even more than
one call controller or equivalent. One approach is that documented in [4].

Figure 4 is a simplified description of a VoIP transit application as found in
[4]. This configuration shows a potential open interface between the Signalling
Gateway and a Call Controller. This may not be necessary if the Call Controller
and SS7 Gateway are implemented in one system.

Note that a Call Controller interworks with a second VoIP MG to complete a call,
and this may or not be through a second Call Controller (see section 3.4).

In fact, the architecture described here is just one of perhaps many that could
be used to provide VoIP transit.



Notes:
- IMT is Inter-Machine Trunk

Figure 4: VoIP Transit Configuration

The call flow for figure 4 is similar to that for figure 2. For VoIP however,
the Call Controller has the extra work of finding and then alerting the terminating VoIP gateway of the call.

3.4 ISUP and TCAP Signalling over IP

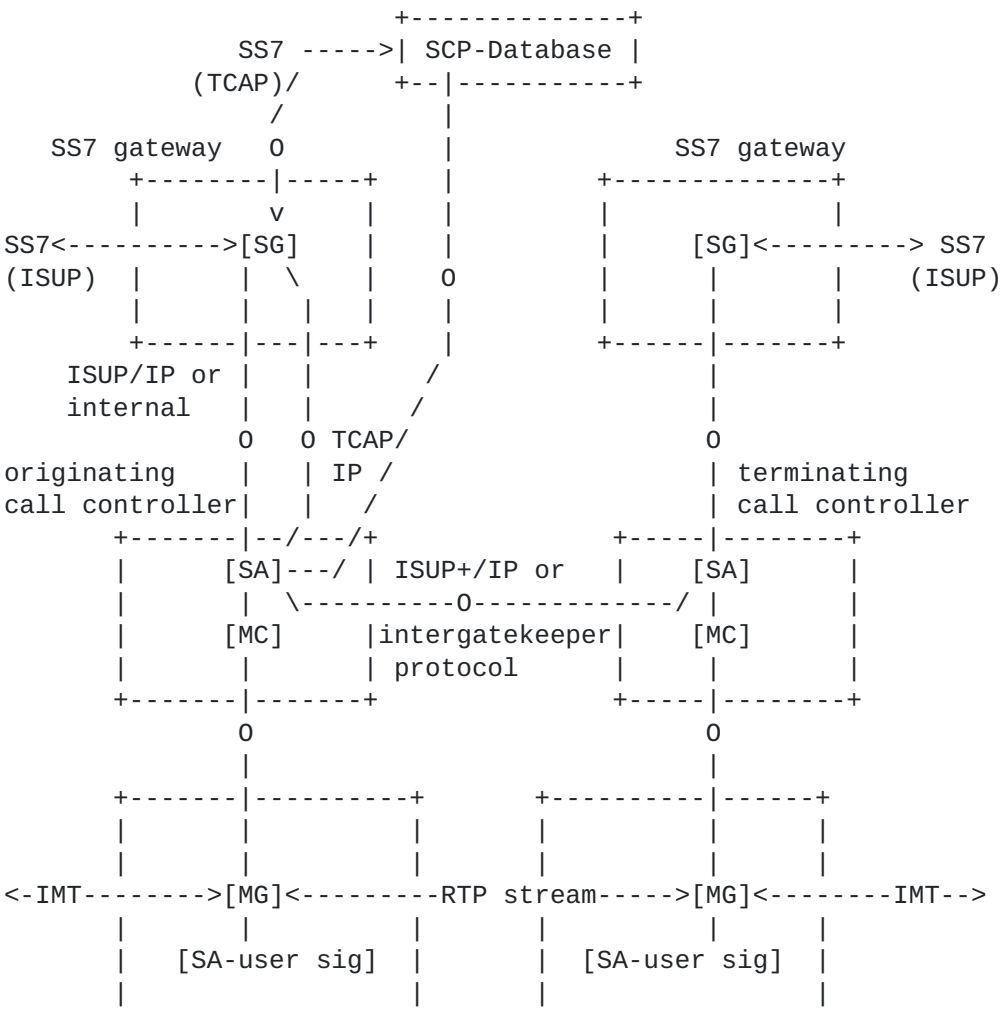
In this section, scenarios involving both SS7 TCAP (Transaction Capabilities)
and ISUP (ISDN User Part) signaling over IP are described.

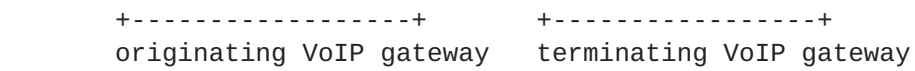
TCAP signaling within IP networks may be used for access to a database. In the
VoIP case the database could be available from the Call Controller. In a NAS

dial-up access case, it could be available from the Signalling Gateway/NAS
Controller. Alternatively, the Signaling Gateway may provide access from SS7

network systems to an IP database (terminating TCAP), or may provide access to
SS7 network databases from an IP system (originating TCAP), subject to services
supported by the SS7 network.

ISUP signaling within IP networks may be used in the context of VoIP. If more
than one Call Controller is used by an implementation of VoIP, then an open
interface between Call Controllers needs to be considered. This interface could
be supported by extensions to SS7 ISUP (ISDN User Part) protocol, carried over
IP (see section 3.5). However, non-SS7 protocols such as H.323 (ITU-T SG16) and
SIP (IETF mmusic) may also apply to this interface. See figure 5.





Notes:
- IMT is Inter-Machine Trunk

Figure 5: ISUP/TCAP Signalling over IP in a particular VoIP Transit Configuration with >1 Call Controller

3.5 Transport of SS7 Signalling (ISUP+TCAP) over IP

SS7 utilizes its own message transport protocol and has defined performance requirements. Supporting SS7 signaling at the SS7 Gateway or within IP networks
requires transport of signaling over IP.

4.0 Next Steps

This document provides a framework to identify the open interfaces that are relevant to introduce useful services that have SS7-Internet interworking as a
major component. From the ordering of the figures in section 3, it proposes an
ordering of importance for standardization of the protocols.

The goal of an SS7-Internet working group would be to decide which protocols are
to be standardized, with what priority, and the functionality necessary in each
protocol.

5.0 References and related work

[1] R. Dalias, J. Matousek, L. Ong, "Bay Networks SS7-Internet Gateway Architecture", draft-ong-ss7-internet-gateway-01.txt, May 1998, work in progress

[2] J. Matousek, L. Ong, "Bay Networks SS7-Internet Access Signaling Protocol",
draft-long-ss7-signal-00.txt, June 1998, work in progress

[3] M. Holdrege, "The Reliable Signaling Gateway Control Protocol", draft-rfced-
info-holdrege-00.txt, June 1998, work in progress

[4] M. Arango, C. Huitema, Simple Gateway Control Protocol (SGCP), draft-huitema-sgcp-v1-00.txt, May 1998, work in progress

[5] F. Cuervo, N. Greene, "Best Current Practice for Modem Outsourcing", draft-
greene-nasreq-00.txt, March 1998, work in progress

[6] P. R. Calhoun, G. Zorn, P. Pan, "Diameter Framework Document", draft-

calhoun-diameter-framework-00.txt, May 1998, work in progress

[7] P. R. Calhoun, A. Rubens, "Diameter Base Protocol", draft-calhoun-diameter-03.txt, April 1998, work in progress

[8] P. R. Calhoun, N. Greene, "Diameter Resource Management Extensions", draft-calhoun-diameter-res-mgmt-01.txt, May 1998, work in progress

[9] N. Greene, F. Cuervo, "Diameter SS7 Session Setup Extensions", draft-greene-diameter-ss7-session-00.txt, July 1998, work in progress

[10] P. R. Calhoun, W. Bulley, "Diameter User Authentication Extensions", draft-calhoun-diameter-authent-03.txt, April 1998, work in progress

[11] S. A. Vakil, P. R. Calhoun, "Diameter IP Security Policy extensions", draft-calhoun-diameter-ipsec-policy-00.txt, March 1998, work in progress

[12] ITU-T Recommendation Q.700, "Introduction to CCITT Signalling System No. 7", March, 1993

[13] ITU-T Recommendation Q.1600, "Signalling System No.7 - Interaction between ISUP and INAP", September, 1997

[IPDC-TAC internet-draft] - to be provided

6.0 Authors

Fernando Cuervo
Nortel
Ottawa, ON, Canada
Phone: 613-763-4628
Email: cuervo@nortel.ca

Nancy Greene
Nortel
Ottawa, ON, Canada
Phone: 613-763-9789
Email: ngreene@nortel.ca

Matt Holdrege
Ascend Communications
1701 Harbor Bay Pkwy
Alameda, CA 94502
Phone: 510-769-6001
Email: matt@ascend.com

Christian Huitema
Bellcore
445 South Street, 1J236B

Morristown, NJ 07960
Email: huitema@bellcore.com

Lyndon Ong
Bay Networks, Inc.
4401 Gt America Pkwy
Santa Clara, CA 95052
Email: long@baynetworks.com

Full Copyright Statement