ATIS-0300219.2013**(R2019)**

INTEGRATED SERVICES DIGITAL NETWORK (ISDN) MANAGEMENT –
OVERVIEW AND PRINCIPLES

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American National Standard for Telecommunications

Integrated Services Digital Network (ISDN) Management – Overview and Principles

Alliance for Telecommunications Industry Solutions

Abstract

This standard provides an overview of the set of standards on management operations for Integrated Services Digital Networks (ISDNs) and establishes the principles for the maintenance and operations needed for overall management of ISDNs. This document provides a general discussion of the models, terminology, and principles utilized to define needed management functionality in customer and network equipment. This standard covers the general concept of the ISDN management process and states the functional ISDN maintenance strategies.

Foreword

The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between providers, customers, and manufacturers. The Telecom Management and Operations Committee (TMOC) develops operations, administration, maintenance and provisioning standards, and other documentation related to Operations Support System (OSS) and Network Element (NE) functions and interfaces for communications networks – with an emphasis on standards development related to U.S.A. communication networks in coordination with the development of international standards.

This particular standard will be useful to anyone engaged in the provisioning or operation of telecommunications equipment to be used within an ISDN. This standard covers the general concept of the ISDN management process, and states the functional ISDN maintenance strategies. It provides an overview of the set of standards on ISDN management and general discussion of the models, terminology, and principles utilized to define needed management functionality in customer and network equipment. This standard is intended to be a living document, subject to revision and updating as warranted by advances in network and terminal equipment technology.

Compliance with this standard does not guarantee the compatibility or acceptable performance of maintenance functions under all operating conditions. In some cases, location-oriented options are needed to ensure compatibility; this need for options is imposed by significant differences between carriers as well as between network elements.

ANSI guidelines specify two categories of requirements: mandatory and recommendation. The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, TMOC, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time of consensus on this document, TMOC, which was responsible for its development, had the following leadership:

> T. Barrett, TMOC Chair (AT&T)
> L. Garbanati, TMOC Vice- Chair (AT&T)
> L. Garbanati, TMOC Technical Editor
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Integrated Services Digital Network (ISDN) Management – Overview and Principles

1 Scope, Purpose, & Application

1.1 Scope

This standard provides an overview and general discussion of the models, terminology, and principles utilized to define needed management functionality in customer and network equipment for ISDN management operations. This standard covers the general concept of the ISDN management process and states the functional ISDN maintenance strategies.

Standards in this set refer to other American National Standards for specification of the details of communications interfaces required for ISDN management. This series of standards does not directly address the maintenance and operations of Signaling System #7 (SS7) networks.

1.2 Purpose

The purpose of this standard is to provide an overview of the set of standards on management operations for Integrated Services Digital Networks (ISDNs) and to establish the principles for the maintenance and operations needed for overall management of ISDNs. This set of standards is intended to establish needed management functionality in customer and network equipment, particularly from the perspective of maintenance functionality available at network interfaces between telecommunication carriers, at the network boundary on the customer's premises, and with operations systems.

1.3 Structure of This Standard

Clause 1 describes the scope, purpose, and structure of this standard. Clause 2 lists the normative references. Clause 3 provides definitions common to the general discussion of ISDN management or utilized by more than one of the other standards in the set. Clause 4 provides general ISDN management models. Clauses 5 and 6 provide ISDN management principles and management strategies that will be built upon by the other standards in the set. Annex A provides examples of potential ISDN management services. Annex B is a bibliography that provides a list of related standards in addition to the normative references.

1.4 Structure of the Set of American National Standards for ISDN Management Operations

The following American National Standards deal with the maintenance aspects of ISDN management operations. Each standard is intended to be capable of standing on its own:

ATIS-0300216. 2013, *Integrated services digital network (ISDN) management – Basic rate physical layer.*[1]

ATIS-0300217. 2013, *Integrated services digital network (ISDN) management – Primary rate physical layer.*[1]

ATIS-0300218. 2013, *Integrated services digital network (ISDN) management – Data link and network layers.*[1]

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[1] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005. < https://www.atis.org/docstore/default.aspx >

2   Normative References

The following standard contains provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below.

ITU-T Recommendation M.20, *Maintenance philosophy for telecommunication networks.*[2]

3   Definitions, Acronyms, & Abbreviations

For a list of common communications terms and definitions, please visit the *ATIS Telecom Glossary*, which is located at < http://www.atis.org/glossary >.

3.1   Definitions

3.1.1   integrated services digital network (ISDN): An integrated services network that provides digital connections between user-network interfaces. See Figure 1.

3.1.2   carrier: A provider of telecommunications services.

3.1.3   digital subscriber line (DSL): A technology that provides full-duplex service on a single twisted metallic pair at a rate sufficient to support ISDN Basic Access and additional framing, timing recovery, and operations functions. The physical termination of the DSL at the network end is the line termination; the physical termination at the customer end is the network termination.

3.1.4   failure: The termination of the ability of an item to perform a required function. A failure is an event.

3.1.5   fault: The inability of an item to perform a required function, excluding inability due to preventive maintenance, lack of external resources, or planned action. A fault is often the result of a failure.

3.1.6   maintenance: A subset of the functions needed to manage an ISDN. It is the combination of all technical and corresponding administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function.

3.1.7   network: A collection of transmission and switching facilities used to establish communication channels.

3.1.8   network element (NE): The telecommunications equipment (groups or parts) within ISDN that provides support, or service, or both, to the customer.

3.1.9   network interface (NI): The point of demarcation between the network and the Customer Installation (CI).

3.1.10   network maintenance: Network maintenance deals with the maintenance of the network provider's entire network. It includes the maintenance of the customer access as well as those parts of other network elements, such as switches, signalling systems, and interoffice transmission facilities, used to provide ISDN services.

3.1.11   operations system (OS): A system that processes information related to telecommunication management to support or to control or to support and control the realization of various telecommunication management functions. To support customer access maintenance, OSs shall perform surveillance and testing functions.

3.1.12   reference point: A conceptual point at the conjunction of two nonoverlapping functional groups. In a specific access arrangement, a reference point may correspond to a physical interface between pieces of equipment, or there may not be any physical interface corresponding to the reference point. There may be more than one physical interface associated with a reference point.

3.1.13   user-to-user maintenance: The set of procedures by which an end-user can manage both the logical and physical aspects of network resources at and between any customer end-points. These procedures permit the management of customer systems and resources, as well as the management of intermediate network

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[2] Available from ITU-T at < http://www.itu.int/en/ITU-T/publications/Pages/recs.aspx >.

resources. Maintenance is done by the customer through monitoring of network quality-of-service and by direct management access to customer systems. Maintenance is also done for the customer systems and network services through customer interaction with intermediate management systems operated by the network providers or management service agents.

3.2 Abbreviations & Acronyms

ATIS	Alliance for Telecommunications Industry Solutions
DSL	Digital Subscriber Line
ISDN	Integrated Services Digital Network
NE	Network Element
NI	Network Interface
OS	Operations Systems

4 Models

ISDN is intended to provide users with a rich set of high quality user-to-user services. ISDN access provides the means by which the customer gains access to these services. Both the access and the user-to-user services need maintenance capabilities.

This clause introduces the concept of access and user-to-user maintenance for ISDN. It describes the models required to define various ISDN maintenance relationships. The models presented in this clause introduce a framework of management terminology that is defined in the appropriate clauses.

4.1 ISDN Access Reference Model

An ISDN access reference model is defined in Figure 2 to show the configuration required to connect an ISDN customer to the network. This model introduces maintenance concepts and associated terminology: customer access (CA), customer installation (CI), and ISDN access maintenance. These are defined in 4.1.1 – 4.1.3.

4.1.1 Customer Access (CA)

The customer access is the portion of the ISDN access that connects the customer installation to the network. The CA is part of the network and includes those network elements or portions of elements that extend from the access switch to the network interface (NI).

4.1.2 Customer Installation (CI)

The customer installation consists of the equipment and facilities at the customer's location on the customer's side of the network interface (NI). It may also contain functions to support management.

4.1.3 ISDN Access Maintenance

At layer 1, maintenance functions extend beyond the NI to the NT1. At layers 2 and 3, maintenance functions extend from the exchange termination (ET) to the NT2/TE1/TA (see Figure 3). Since services cross the NI, failure location is important to both the network provider and the customer. Maintenance procedures regarding the layer 1, 2, and 3 protocols cross the NI and are therefore the joint responsibility of the network and the customer.

4.2 Management Domain Model

Figure 4 shows a management domain model to allow means for defining management control relationships. Figure 4 introduces management terminology and defines functional relationships between various management domains.

4.2.1 Management Domain Terminology

The terminology used is defined in 4.2.1.1 – 4.2.1.6.

4.2.1.1 Managed Objects

Information processing or telecommunication resources that are managed by management functions.

4.2.1.2 Managed System

One or more application processes that represent the management functions for one or more managed objects.

4.2.1.3 Management Domain

A collection of one or more management complexes and zero or more managed systems and subsidiary domains that are administered by a single organization. A management domain is a repository of information and procedures used to manage the objects of the domain.

4.2.1.4 Management Functions

The categories of management functions are:

- Fault management;

- Accounting management;

- Configuration and name management;

- Performance management; and

- Security management.

4.2.1.5 Management Processes

For the purposes of systems management, management processes are categorized either as managing processes or agent processes. A managing process is that part of a distributed application process that has responsibility for one or more management activities. An agent process is that part of a distributed application process that, at the request of a managing process, manages the associated managed objects. An agent process performs the management function upon receipt of a directive specifying management operations on managed objects. Agent processes may also forward directives to managing processes to convey information (or notifications) generated by managed objects.

4.2.1.6 Management System

An application process within a management domain that performs or causes monitoring and control of objects in that domain or manages the actions targeted for other domains.

4.2.2 Management Domain Relationships

The manipulation and control of managed objects is determined by the relationship of management domains. Two basic relationships exist that cover the interaction of management access to managed objects.

4.2.2.1 Peer Relationship:

A peer relationship is defined as one in which each complex (including its supporting management systems, if present) is responsible for the managed objects in its domain and whereby no peer management system can control objects outside its domain. The complex and the managed systems are in the same domain. Interaction between domains may occur but only on a request, not a command, basis.

4.2.2.2 Hierarchical Relationship:

A hierarchical relationship is defined as one in which managed objects in a (sub-) domain may be accessed and controlled by either the complex of the (sub-) domain it is within or by the complex of a domain that includes the subdomain of the managed system.

Figure 4 illustrates these relationships. Domains A and B have a hierarchical relationship. Complex A may control managed systems 1 and 2. It may also control managed systems 3 and 4 either directly or by interacting with complex B. Domains A and C have a peer relationship. For example, Complex C may interact with managed system 1 only via an interaction with complex A.

4.3 ISDN Management Domain Model

This subclause presents a model for management control relationships for ISDN. The model is used for illustrative purposes only and does not preclude any specific management control functions from being provided by either the customer or the network. The equipment and functions defined in this subclause may be centralized or distributed, as appropriate.

4.3.1 ISDN Management Domain Terminology

The relationship between the network provider, customer, and third party maintenance providers is discussed in terms of the terminology defined in 4.3.1.1 – 4.3.1.2, and shown in Figure 5. A complex consists of network elements, operations systems, and staff. A complex is responsible for management functionality. Figure 6 shows the relationships of these definitions to the domain model.

4.3.1.1 Administration Management Complex (AMC)

Administration in this document is taken to mean the network provider. An AMC represents a complex controlled by a network provider, which has the responsibility and capability for (among other management functions) the maintenance functions and the maintenance actions within a network. (The domain of the AMC is the network.) The management functionality of an AMC is distributed among network elements, operation systems, and staff.

4.3.1.2 Customer Management Complex (CMC)

A CMC represents a complex controlled by a customer, which has the responsibility and capability for (among other management functions) the maintenance functions and the maintenance actions within a customer's installations, and for the maintenance, from the customer's point-of-view, of the services that the ISDN provides. The domain of the CMC includes the CI. The management functionality of a CMC is distributed among customer installation elements, operation systems, and staff. Note that the CMC may be provided by the customer or by another party or by some combination of the two.

4.3.1.3 Management Service Complex (MSC)

The MSC represents a complex, provided by a third party, which has the responsibility for maintaining some service provided to the customer or some equipment provided by the customer or both. The MSC does not control the maintenance functions of the customer access (CA) or customer installation (CI) directly, but can request such functions of the AMC or CMC, respectively.

4.3.1.4 ISDN Management Domain Relationships

The maintenance of the ISDN access is the shared responsibility of the AMC (responsible for CA maintenance) and the CMC (responsible for CI maintenance). User-to-user maintenance may be provided by the interaction of MSCs with various AMCs and CMCs, as needed and authorized. As an example, Figure 7 shows four public ISDNs and one private ISDN. Several CIs, each with a CMC, are shown attached to these ISDNs via standard ISDN interfaces. Each public ISDN is shown with an AMC that may be distributed. MSCs are shown as being provided by third parties. ISDN access and end-to-end circuits and services are maintained by an interaction of MSCs, AMCs, and CMCs.

4.4 User Management Communications Model

As shown in Figure 8, the user of ISDN can obtain management services through three distinct communications paths: end-to-end between CMCs, between the CMC and AMCs, and between the CMC and MSCs. The communications model describes each of these relationships, the model components, and the paths between components required to achieve the network management objective.

4.4.1 CMC-to-CMC Management Communications Model

For end-to-end management, the users rely on the relationships within or between the customer management complexes (CMCs) to provide overall management coordination. This communication may be achieved through the use of ISDN services.

4.4.2 CMC-to-AMC Management Communications Model

Communications to the AMC from the CMC provide information about the management of the customer access and ISDN services.

4.4.3 CMC-to-MSC Management Communications Model

The CMC may request the MSC to act as a coordinator for ISDN management services. This may require both CMC-to-MSC and MSC-to-AMC communications. An MSC may request management services from several AMCs for a user.

4.5 Telecommunications Management Network

4.5.1 Basic Concept

The telecommunications management network (TMN) is a management support network intended to overlay the telecommunications network and provide for the management of that telecommunications network. The basic concept behind the TMN is to provide an organized network structure to achieve the interconnection of the various types of OSs and telecommunications equipment using an agreed upon architecture with standardized protocols and interfaces. A TMN will provide many management functions and will offer communications both between OSs and between the OSs and the various network elements (NEs). It will be used to manage both the individual NEs and the overall networks themselves, including ISDNs.

4.5.2 Relationship of the TMN to the ISDN

Figure 9 shows the relationship of the TMN to the ISDN network that it manages. Note that, functionally, the TMN is not part of the ISDN, but is a separate network that interfaces with it at a number of different points to receive information from and to control its management operations. It may, however, use part of the ISDN network to provide TMN communications.

5 Principles

5.1 Maintenance Principles

ISDN access maintenance should follow the general maintenance philosophy contained in ITU-T Recommendation M.20. This recommendation discusses phases that maintenance procedures go through during the process of normal functioning through the restoration of failures. ISDN will have particular impact on the following phases:

- Performance measurement (this term includes the use of performance monitoring.);

- Failure detection;

- System protection;

- Fault localization;

- Fault correction;

- Verification; and

- Restoration.

5.2 Principles for Definition of Managed Objects

For purposes of ISDN management, managed objects are defined for ISDN entities. The definition process consists of the following:

- Selection of appropriate object classes;

- Definition of relevant attributes; and

- Description of expected behavior.

For example, in order to provide flexible maintenance operations, the basic rate interface and primary rate interface, along with the B, D, and H channels they carry, may be treated as managed objects. An example of an attribute associated with ISDN interfaces or channels is the management service state. The behavior of management service states may be characterized by the ability to alter the values, in-service or out-of-service.

6 Strategies

6.1 General

The fundamental maintenance strategy is to rely on performance measurement wherever possible in order to apply the controlled maintenance principles of ITU-T Recommendation M.20.

The maintenance capabilities provided should allow for the clear differentiation of troubles between the customer and the network equipment.

The maintenance capabilities provided shall allow for clear differentiation between failures and legitimate customer activities.

Testing will be needed both to supplement the performance monitoring for trouble detection and to provide additional trouble localization ability.

A capability should be provided to control the status of the customer access and of the customer equipment during maintenance operations. The customer or his private MSC may be given a restricted subset of this capability.

6.2 *Protocol Maintenance*

The progression of maintenance tools used for protocol trouble resolution may include continuous in-service monitoring, on-demand in-service monitoring, and – finally – out-of-service testing. An example of on-demand in-service monitoring is protocol capture. Protocol capture allows a non-disruptive capture of protocol activity on an active line. This information may then be analyzed to isolate protocol problems.

6.3 *ISDN Management Services*

There is a need to exchange management information across the interface between AMCs and CMCs. If a management service complex (MSC) is used for the ISDN access being managed, then it may also need to exchange similar information with the AMC and the CMC. The following list describes several examples of management information that will need to be exchanged between the CMC, the AMC, and perhaps the MSC. Annex A describes examples of potential ISDN management services that may be used to partially satisfy this need.

a) Configuration management information for managed systems. This information is exchanged between domains to allow ISDN service parameters to be assigned and updated.

b) Alarm/status information for managed systems.

c) Performance monitoring information for managed systems.

d) Maintenance state information and control. When maintenance action is desired by one of the complexes, there will be a need to determine the current maintenance state (and, perhaps, the current sub-state) of managed systems in the domain of the other complex. In order to perform a desired action, it may also be necessary to request a change in that state.

e) Test operation. Some tests that are necessary for the maintenance of managed systems in the domain of one of the complexes may require establishing conditions (such as loopbacks) or performing tests (such as protocol tests) involving managed systems in the domain of the other complex.
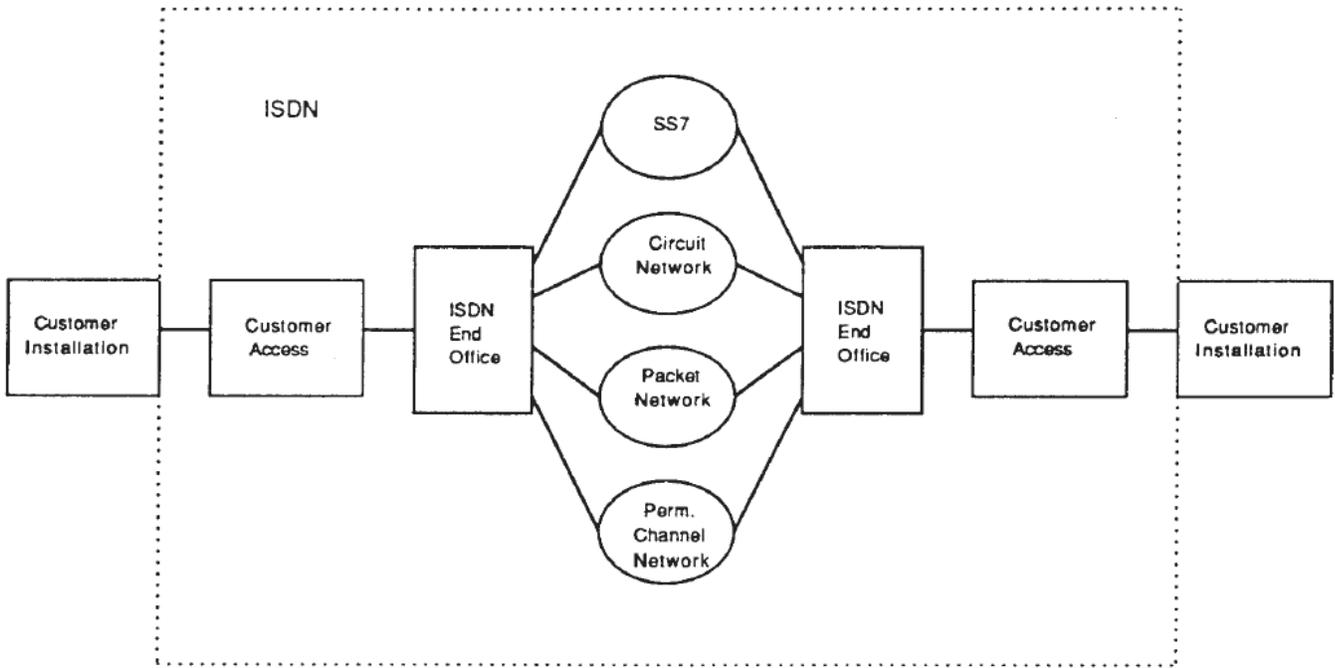
NOTE – This figure shows the operational boundary of an ISDN, which, in certain instances, may include part of the customer installation. SS7 = Common Channel Signalling System Number 7 Network; Circuit Network = Circuit-Switched Digital Network; Packet Network = Packet-Switched Digital Network; Permanent Channel Network = Dedicated, Nonswitched, Digital Network.

Figure 1 - ISDN
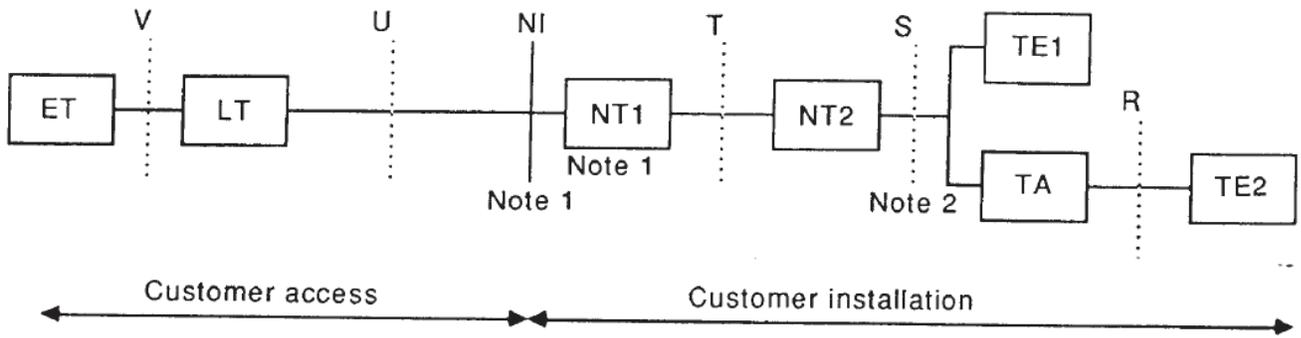
ET = Exchange Termination   NI = Network Interface   TE = Terminal Equipment
LT = Line Termination   NT = Network Termination   TA = Terminal Adapter

NOTES

1   In most cases, the NI is located on the network side of the NT1. In certain cases, the NI may be located at a point that is functionally equivalent to the T reference point.

2   The passive bus arrangement applies to the Basic Rate Access.

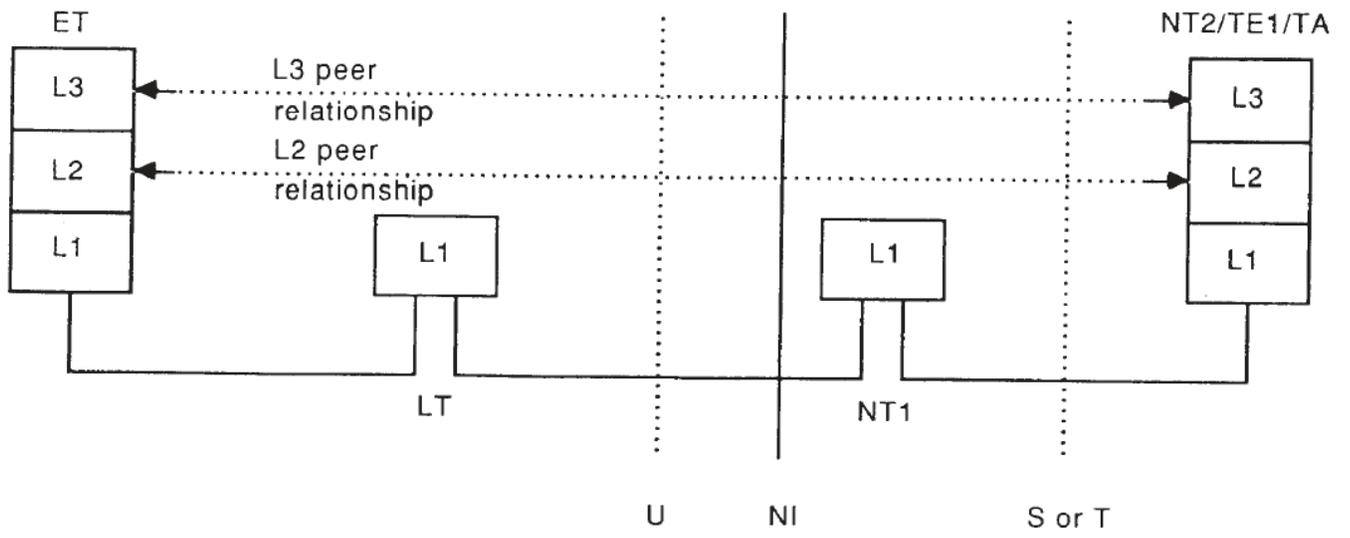**Figure 2 - ISDN Access Reference Configuration**
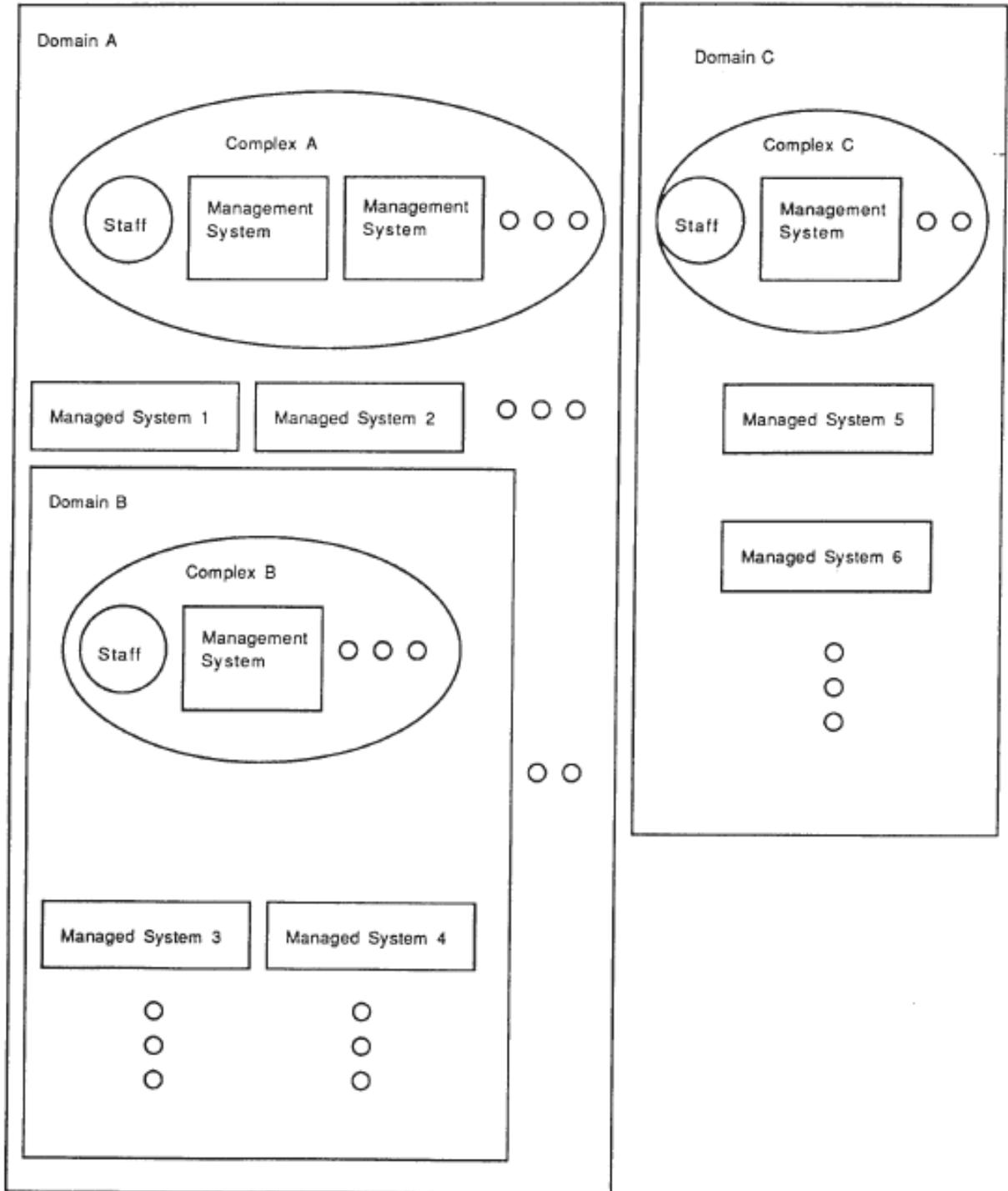
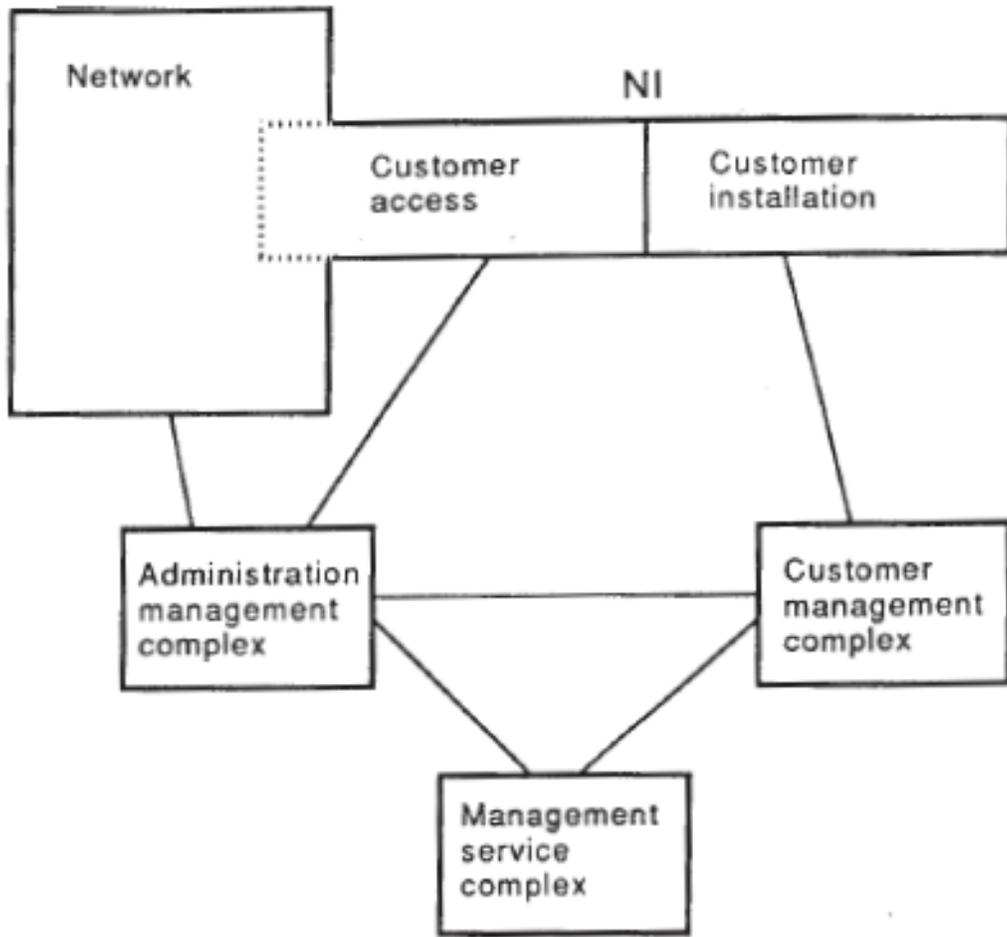**Figure 3 - Peer Relationships**

Figure 4 - Management Domain Model

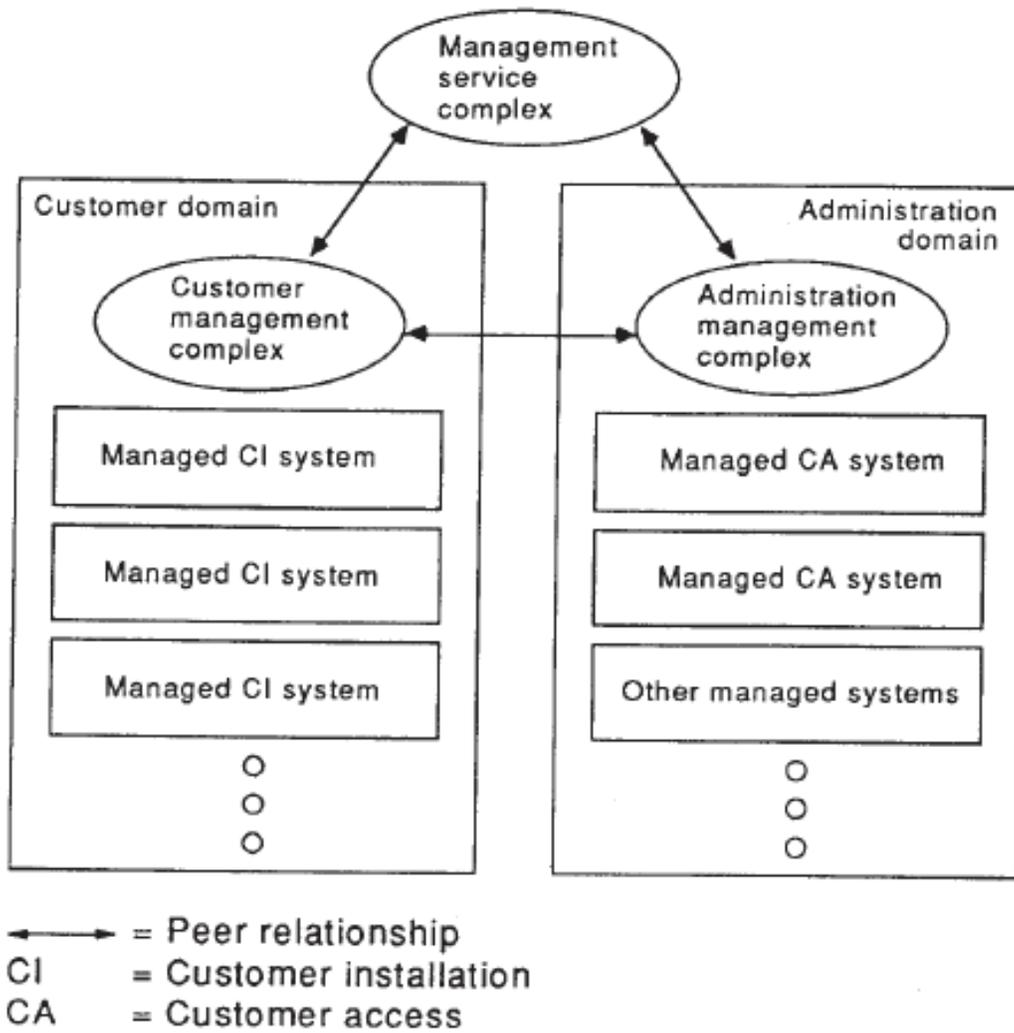**Figure 5 - Functional Relationships between ISDN Elements and Management Complexes**
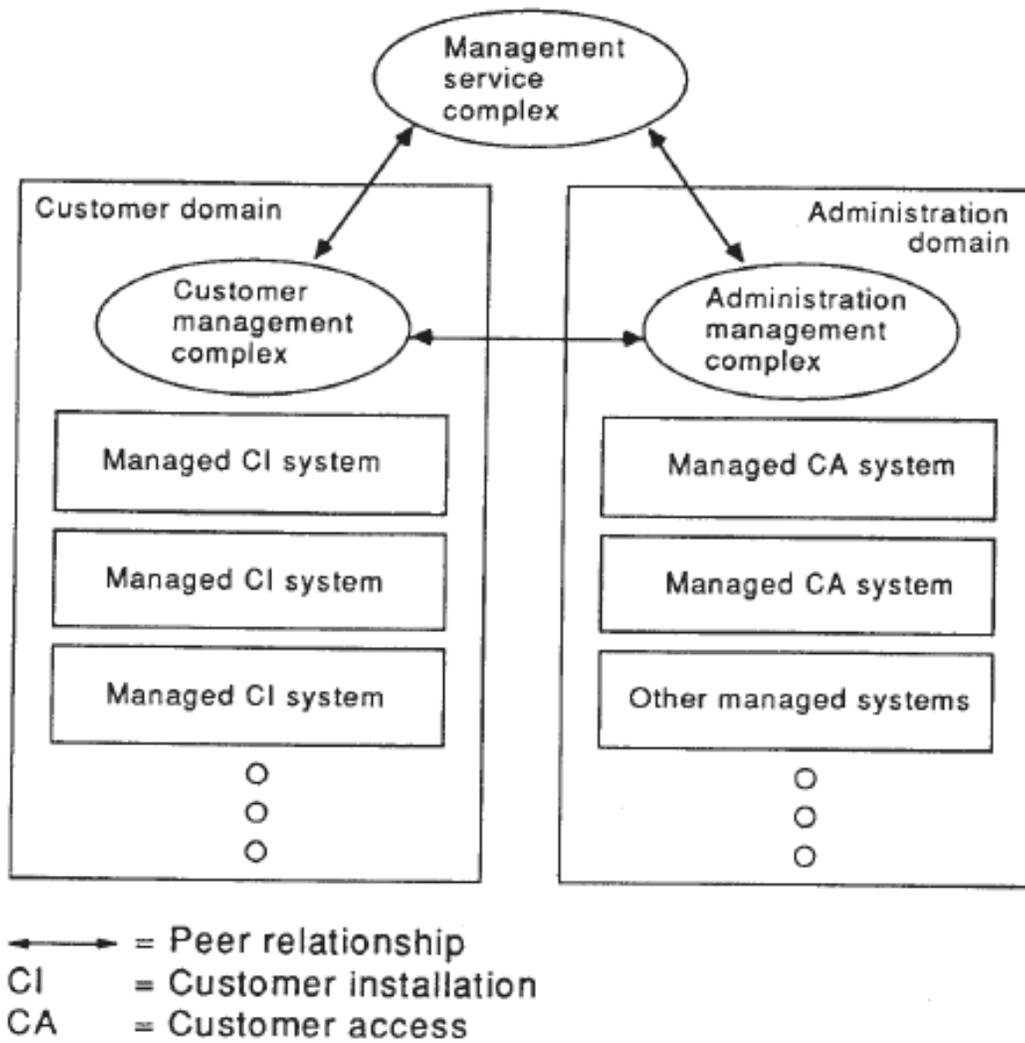
Figure 6 - Domain Model of ISDN Management Relationships
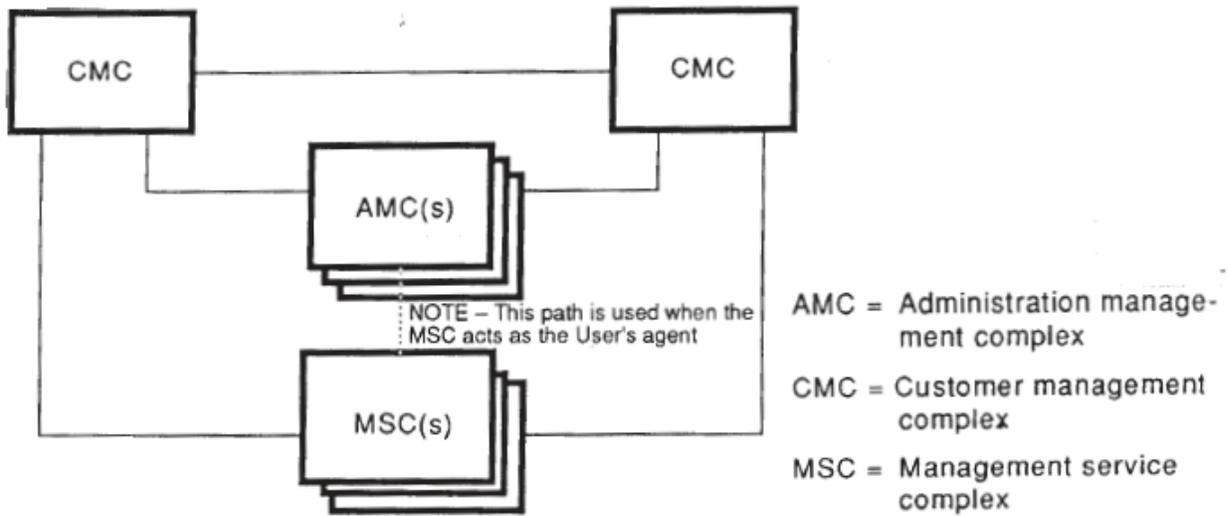
Figure 7 - Example of Multiple ISDNs and Supporting Complexes

Figure 8 - User Management Services Communications Relationships in ISDN
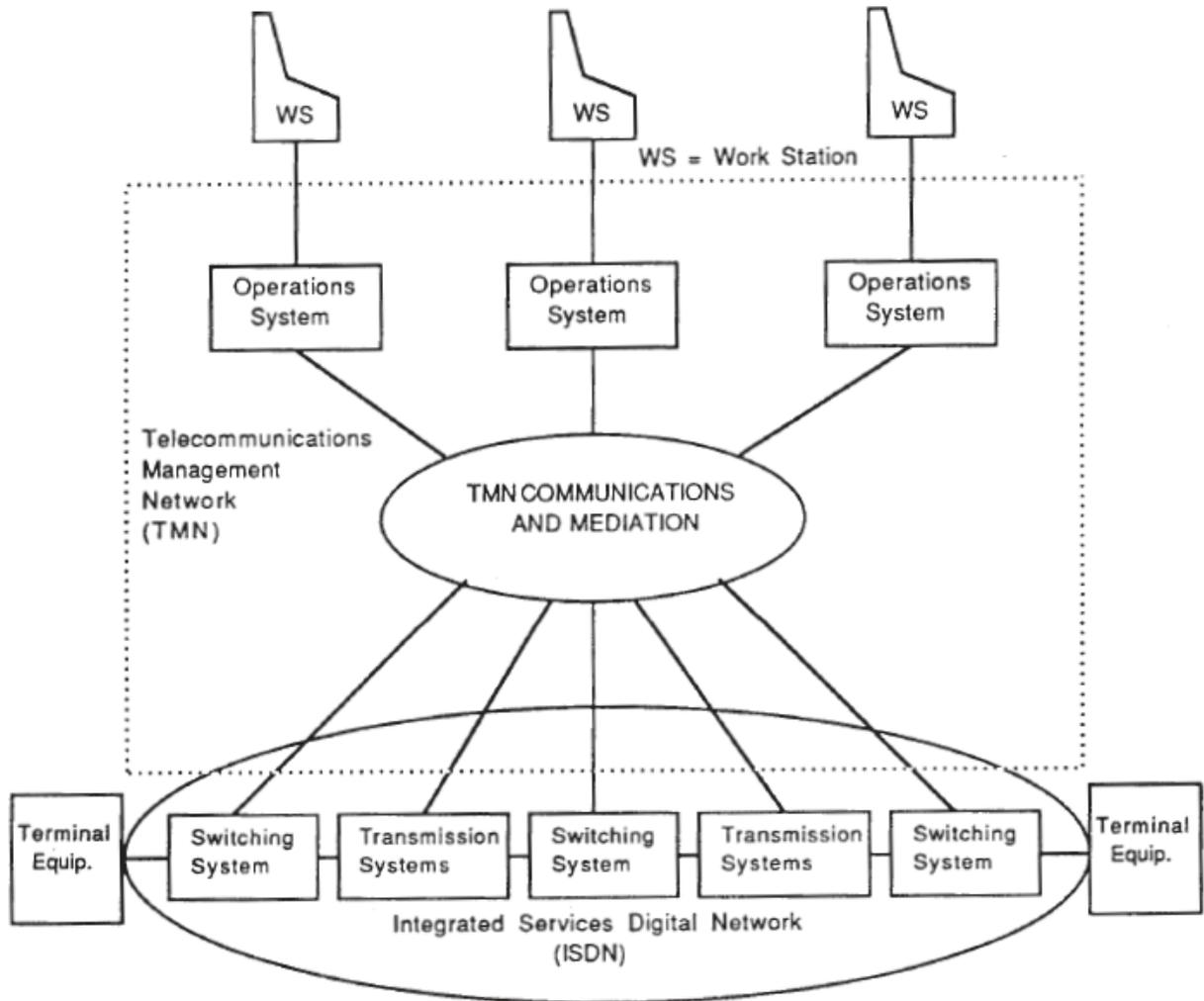
AMC = Administration manage-
ment complex

CMC = Customer management
complex

MSC = Management service
complex

NOTE – This path is used when the MSC acts as the User's agent

Figure 9 - Relationship of TMN to ISDN

Annex A
(informative)

A   Examples of Potential ISDN Management Services

A.1   General

The shared management of an ISDN access may be supported by network-based management services available to the customer.

A.2   Examples

Examples of these types of management services are briefly described below. The list is not considered to be comprehensive.

- The ISDN exchange may provide a management service that will download service profile parameters to the associated terminal on the access. Customer equipment and personnel on the access may use the information to initialize, or verify the network understanding of their service profile.

- The ISDN exchange may provide a management service that will provide a means for the ET to request activation and deactivation of bearer channel loopbacks within the terminal equipment (TEs and NT2s) at a layer above the physical layer. This service should be symmetric. That is, the terminal may request activation (and deactivation) of loopbacks that are within the ET. These loopbacks will support testing of the access transmission path by both the user and the network.

- An ISDN exchange may provide a management service that will provide a means for it to notify an NT2 (which may notify a CMC) at the other end of a BRA or a PRA about management state changes on bearer channels between them. Customer equipment and personnel may use the state change information to alter calling procedures or testing procedures or both, or for other management activities. This service should also be symmetric – i.e., provide a means for the NT2s to notify the ISDN exchange (which then may notify its associated AMC) about state changes on bearer channels between them.

Annex B: Bibliography

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