Technical Specification Group Services and System Aspects **TSGS#8(00)0245**
Meeting #8, Düsseldorf, Germany, 26-28 June 2000

Source: **SA5 (Telecom Management)**

Title: **32.106 CR, "Split of TS - Part 8: Name Convention for Managed Objects" (S5-000327)**

Document for: **Approval**

Agenda Item: **6.5.3**

SA5 has split TS 32.106 Configuration Management (CM) into a multi-part TS as identified below:

Part 1: "3G Configuration Management";
Part 2: "Notification IRP Information Service";
Part 3: "Notification IRP CORBA Solution Set";
Part 4: "Notification IRP CMIP Solution Set";
Part 5: "Basic Configuration Management IRP Information Model (including NRM)";
Part 6: "Basic Configuration Management IRP CORBA Solution Set";
Part 7: "Basic Configuration Management IRP CMIP Solution Set"

Part 8: "Name Convention for Managed Objects"

Five (5) CRs are submitted to SA#8 for approval; the present one is highlighted in yellow:

Spec	CR	Phase	Subject	Cat	Version - Current	Version -New	Doc-2nd-Level
32.106	001	R99	Split of TS - Part 1: Main part of spec - Concept and Requirements	F	3.0.1	3.1.0	S5-000323
32.106	002	R99	Split of TS - Part 2: Notification IRP Information Service (IS)	F	3.0.1	3.1.0	S5-000324
32.106	003	R99	Split of TS - Part 3: Notification IRP CORBA SS	F	3.0.1	3.1.0	S5-000325
32.106	004	R99	Split of TS - Part 4: Notification IRP CMIP SS	F	3.0.1	3.1.0	S5-000326
32.106	005	R99	Split of TS - Part 8: Name Convention for Managed Objects	F	3.0.1	3.1.0	S5-000327

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

32.106 CR 005 Current Version: 3.0.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	SA#8	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*

(U)SIM	ME	UTRAN / Radio	Core Network
		X	X

Source:	SA5#12
Date:	20 June 2000
Subject:	Split of TS - Part 8: Name Convention for Managed Objects
Work item:	32.106 Configuration Management

Category: *(only one category shall be marked with an X)*

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: In addition to the split of 32.106 to 8 parts, a few minor technical corrections and clarifications of this document have been agreed by SA5.

Clauses affected: All.

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

3G TS 32.106-8 V3.0.1ca (2000-064)

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Contents

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

Configuration Management (CM), in general, provides the operator with the ability to assure correct and effective operation of the 3G network as it evolves. CM actions have the objective to control and monitor the actual configuration on the NEs and NRs, and they may be initiated by the operator or functions in the OSs or NEs.

CM actions may be requested as part of an implementation programme (e.g. additions and deletions), as part of an optimisation programme (e.g. modifications), and to maintain the overall Quality of Service. The CM actions are initiated either as a single action on a network element of the 3G network or as part of a complex procedure involving actions on many network elements.

~~In this document, Clauses 4 through 6 are here provided to give an introduction and description of the main concepts of configuration management, which is not mandatory for the compliance to this specification in this release. Clause 7 contains the specific definitions for the standardised N-interface, which are necessary to follow for compliance.~~

~~Clause 4 provides a brief background of CM while Clause 5 explains CM services available to the operator. Clause 6 breaks these services down into individual CM functions, which support the defined services. Clause 7 defines the N-INTERFACEinterface to be used for 3G CM.~~

The Itf-N interface for Configuration Management is built up by a number of Integration Reference Points (IRPs) and a related Name Convention, which realise the functional capabilities over this interface. The basic structure of the IRPs is defined in [1] and [2]. For CM, a number of IRPs (and the Name Convention) are defined herein, used by this as well as other technical specifications for telecom management produced by 3GPP. All these documents are included in Parts 2-N the 3G TS 32.106.

This document consitutes 32.106 Part 8 (32.106-8) – Name Convention for Managed Objects.

Current problems

At present, multiple name conventions are used by different vendors' network elements (NEs), or even within the same vendor, to name network resources. Following problems arise:

- Different classes of NE use different name conventions. Network Management applications, when interfacing with these NEs, are required to understand multiple name conventions to manage the NEs.

- Network management applications (e.g., fault management application), when interfacing with other applications (e.g., configuration management application, trouble ticket system) are required to understand multiple name conventions.
- When a customer purchases multiple classes of NEs from the same or different vendors, the customer is confronted with multiple name conventions.
- Without a name convention, it is difficult to integrate IRP conformant vendors' resource name space (see subclause 3.1.5 for definition of name space) into the customer's Enterprise name space.

Benefits

This subclause lists the benefits of using the subject name convention to name 3G network resources for network management purposes.

- A resource name is guaranteed to be unambiguous in that it refers to, at most, one network resource. Unambiguous naming of managed network resources is necessary for interoperability among managing applications and systems.
- The resource name syntax is specified such that management applications can be designed with assurance that its name-parsing algorithm needs not be modified in the future. We can derive this benefit only if the subject name convention is widely accepted.

The root and upper portions of the name hierarchy are based on name infrastructure of Domain Name System (DNS) [5]. The subject name convention can naturally fit in DNS and can integrate well with other hierarchical naming systems, such as X.500 [2].

1 Scope

The present document describes the Configuration Management (CM) aspects of managing a 3G network. This is described from the management perspective outlined in the two 3GPP specifications 32.101 [1] and 32.102 [2].

The present document defines a set of controls to be employed to effect set-up and changes to a 3G network in such a way that operational capability and quality of service, network integrity and system inter working are ensured. In this way, the present document describes the interface definition and behaviour for the management of relevant 3G network NEs in the context of the described management environment. The context is described for both the management systems (OS) and NE functionality.

Clause 7 contains the specific definitions for the standardised N-interface, which are necessary to follow for compliance to this specification.

For a more detailed background and introduction of the IRP concept, please refer to 3G TS 32.101 [11] and 32.102 [12].

To perform network management tasks, co-operating applications require identical interpretation of names assigned to network resources under management. Such names are required to be unambiguous as well. This document recommends one name convention for network resources under management in the IRP context.

To facilitate integration of network management information obtained via multiple IRPs of different technologies such as CMIP and CORBA, identical network resource name semantics must be conveyed in all IRPs. This document specifies one such name convention.

2 References

The following documents contain provisions, which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] Intentionally left blank.

[2] ITU-T Recommendation X.500 (11/93): "Information technology - Open Systems Interconnection - The directory: Overview of concepts, models, and services"

[3] ISBN 1-57870-070-1: "Understanding and Deploying LDAP Directory Services, T.Howes".

[4] IETF RFC1737: "Functional Requirements for Uniform Resource Names", 1994.

[5] IETF RFC2247: "Using Domains in LDAP Distinguished Names", January 1998.

[6] IETF RFC1035: "Domain Name – Implementation and Specification", November 1987.

[7] IETF RFC2253: "Lightweight Directory Access Protocol version 3: UTF-8 String Representation of Distinguished Name", December 1997.

[8] 3G TS 32.111-2: "Alarm IRP: Information Service"

[9] 3G TS 32.106-5: "Basic Configuration Management IRP: Information Model"

[10] IETF RFC733: "Standard for the Format of ARPA Network text messages"

[11] 3G TSPP 32.101: "3G Telecom Management principles and high level requirements".

[12] 3G TSPP 32.102: "3G Telecom Management architecture".

[13] 3G TS 32.106-2: “Notification IRP: Information Service”.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply. This subclause defines terms essential for understanding of name convention in the IRP context. For terms and definitions not found here, please refer to [1],[2] and [14].

3.1.1 IRPAgent

See [13].

3.1.2 IRPManager

See [13].

3.1.3 Managed Object and Network Resource

In the context of this document, a Managed Object (MO) is a software object that encapsulates the manageable characteristics and behaviour of a particular network resource. Examples of network resource are switch, scanner for monitoring performance data, cell, site, transmission links, satellite, operator profile, etc. In this document, MO sometimes is referred to as MO instance.

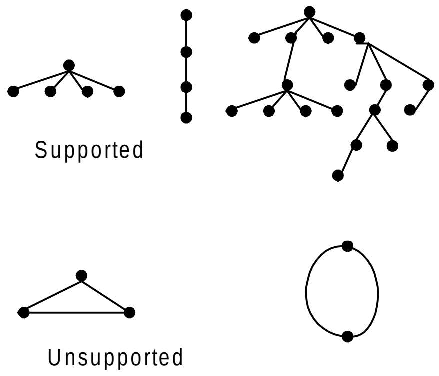
3.1.4 Name

In the context of this document, a name is restricted to the identification of a Managed Object (MO), that is, a software object representing a real network resource.

3.1.5 Name space

A name space is a collection of names. This name convention uses a hierarchical containment structure, including its simplest form - the one-level, flat name space. This name convention does not support an arbitrarily connected name space, or graph structure, in which a named object can be both child and parent of another named object. The following figure shows some examples of supported and unsupported name spaces (The figure is from [3]. It provides useful information on name space design).

Figure 11: Examples of supported and unsupported name spaces



3.1.6 Global Root and Local Root

Names in name space are organised in hierarchy. A MO instance that contains another is said to be the superior (parent); the contained MO instance is referred to as the subordinate (child).

In modern network management, it is expected that the Enterprise name space be partitioned for implementations in multiple managed system (see Appendix C for reasons of name space partitioning). The parent of all MO instances in a single managed system is called the Local Root. The ultimate parent of all MO instances of all managed systems is called the Global Root.

3.1.7 Distinguished Name and Relative Distinguished Name

A Distinguished Name (DN) is used to uniquely identify a MO within a name space. A DN is built from a series of "name components", referred to as Relative Distinguished Names (RDNs). ITU-T Recommendation X.500 [2] defines the concepts of DN and RDN in detail, using ASN.1, in the following way:

```
DistinguishedName ::= RDNSequence
RDNSequence ::= SEQUENCE OF RelativeDistinguishedName
   RelativeDistinguishedName ::= SET SIZE (1..MAX)
 OFAttributeTypeAndValue
AttributeTypeAndValue ::= SEQUENCE {
     type AttributeType, value AttributeValue}
```

This document references this ASN.1 structure but it only uses single-valued (not multi-valued) RDN.

From a DN of a MO, one can derive the DN of its containing MO, if any. This containment relation is the only relation carried by the DN. No other relation can be carried or implied by the DN.

See Appendix B for a rule for MO designers to avoid ambiguity concerning the `AttributeType` of a DN string.

See Appendix C for discussion of DN prefix.

Data: is any information or set of information required to give software or equipment or combinations thereof a specific state of functionality

Element Manager (EM): provides a package of end-user functions for management of a set of closely related types of network elements. These functions can be divided into two main categories:

- *Element Management Functions* for management of network elements on an individual basis. These are basically the same functions as supported by the corresponding local terminals.

- *Sub-Network Management Functions* that are related to a network model for a set of network elements constituting a clearly defined sub-network, which may include relations between the network elements. This model enables additional functions on the sub-network level (typically in the areas of network topology presentation, alarm correlation, service impact analysis and circuit provisioning).

Equipment: is one or more hardware items which correspond to a manageable or supervisable unit or is described in an equipment model

Firmware: is a term used in contrast to software to identify the hard-coded program, which is not downloadable on the system

Hardware: is each and every tangible item

IRP Information Model: See [1].

IRP Information Service: See [1].

IRP Solution Set: See [1].

Managed Object (MO): an abstract entity which may be accessed through an open interface between two or more systems, and representing a Network Resource for the purpose of management. The MO is an instance of a Managed Object Class (MOC) as defined in a Management Information Model (MIM). The MIM does not define how the MO or NR is implemented; only what can be seen in the interface

Managed Object Class (MOC): a description of all the common characteristics for a number of MOs, such as their attributes, operations, notifications and behaviour

Managed Object Instance (MOI): an instance of a MOC, which is the same as a MO as described above

Management Information Base (MIB): the set of existing managed objects in a management domain, together with their attributes, constitutes that management domain's MIB. The MIB may be distributed over several OS/Nes

Management Information Model (MIM): also referred to as NRM – see the definition below. There is a slight difference between the meaning of MIM and NRM – the term MIM is generic and can be used to denote any type of management model, while NRM denotes the model of the actual managed telecommunications network resources

Network Element: is a discrete telecommunications entity, which can be, managed over a specific interface e.g. the RNC

Network Manager (NM): provides a package of end-user functions with the responsibility for the management of a network, mainly as supported by the EM(s) but it may also involve direct access to the network elements. All communication with the network is based on open and well-standardized interfaces supporting management of multi-vendor and multi-technology network elements

Network Resource: is a component of a Network Element which can be identified as a discrete separate entity and is in an object oriented environment for the purpose of management represented by an abstract entity called Managed Object

Network Resource Model (NRM): a model representing the actual managed telecommunications network resources that a System is providing through the subject IRP. An NRM describes managed object classes, their associations, attributes and operations. The NRM is also referred to as "MIM" (see above) which originates from the ITU-T TMN

Object Management Group (OMG): see http://www.omg.org

Operations System (OS): indicates a generic management system, independent of its location level within the management hierarchy

Operator: is either

- a human being controlling and managing the network; or
- a company running a network (the 3G network operator)

Optimisation: of the network is each up-date or modification to improve the network handling and/or to enhance subscriber satisfaction. The aim is to maximise the performance of the system

Re-configuration: is the re-arrangement of the parts, hardware and/or software that make up the 3G network. A re-configuration can be of the parts of a single NE or can be the re-arrangement of the NEs themselves, as the parts of the 3G network. A re-configuration may be triggered by a human operator or by the system itself

Reversion: is a procedure by which a configuration, which existed before changes were made, is restored

Software: is a term used in contrast to firmware to refer to all programs which can be loaded to and used in a particular system

Up-Dates: generally consist of software, firmware, equipment and hardware, designed only to consolidate one or more modifications to counter-act errors. As such, they do not offer new facilities or features and only apply to existing Nes

Up-Grades: can be of the following types:

- enhancement - the addition of new features or facilities to the 3G network;
- extension - the addition of replicas of existing entities.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ASN.1	Abstract Syntax Notation One
BER	Basic Encoding Rules
BNF	Backus-Naur Form
CM	Configuration Management
CMIP	Common Management Information Protocol
CORBA	Common Object Request Broker Architecture
DC	Domain Component
DN	Distinguished Name
DNS	Domain Name Service
EM	Element Manager
FM	Fault Management
FW	Firmware
HW	Hardware
IETF	Internet Engineering Task Force
IRP	Integration Reference Point
ITU-T	International Telecommunication Union, Telecommunication Standardisation Sector
LDN	Local Distinguished Name
MIB	Management Information Base
MIM	Management Information Model
MO	Managed Object
MOC	Managed Object Class
MOI	Managed Object Instance
NE	Network Element
NM	Network Manager
NR	Network Resource
NRM	Network Resource Model
OMG	Object Management Group
OS	Operations System
OSF	Operations System Function
SW	Software
TRX	Transceiver
RDN	Relative Distinguished Name
TS	Technical Specification
UML	Unified Modelling Language (OMG)

4 System Overview

4.1 System context

Following are situations under which MO (representing network resource) names will be used.

- MO names will cross various Integration Reference Points (IRPs).

  Example 1: In the context of Alarm IRP [8], IRPAgent notifies IRPManager of the alarm condition of a network resource. The DN of the MO, representing alarmed network resource, encoded as specified in this document, is carried in the `Managed Object Instance` parameter of the notification.

  Example 2: In the context of Configuration Service IRP [9], IRPAgent notifies IRPManager of the creation of new object. The DN of the newly created object, encoded as specified in this document, is carried in the notification.

  Example 3: In the context of Configuration Service IRP [9], IRPManager requests IRPAgent to search for a particular object by specifying the start point of the search. The DN of the base object, upon which the search begins downward hierarchically, is carried in the request.

- Co-operating management applications need to exchange information that includes MO (representing network resource) names.

  Example 1: A fault management application may request a trouble ticket system to open a new trouble ticket reporting the alarmed condition of a network resource by specifying, among other things, the MO name representing the alarmed network resource. The DN of the MO, encoded as specified in this document, is included in the request.

  Example 2: A performance management system that produces reports on performance of network resources. The DNs of the MOs, representing the reported network resources, encoded as specified in this document, are printed on the report.

5 Name Convention for Managed Objects

Network resources shall be named using name convention of X.500 [2] with one restriction listed below. Central to the X.500 name convention is the concept of Distinguished Name (DN). See 3.1.7.

The restriction is that this IRP name convention does not support multi-valued RDN. It only supports single-value RDN.

6 Representations of DN

DN can be encoded and represented in many ways. This document specifies two representations. Future IRP work may specify other representations.

- DN is encoded using ASN.1/BER encoding scheme. Traditional TMN compliant systems use this encoding scheme. IRP CMIP Solution Set compliant systems shall use this scheme. Since this scheme is documented in ITU-T X.500 Recommendation, their specification is not repeated here.
- DN is encoded using string representation. This document contains the specification of this scheme.

7 String Representation of DN

This clause specifies the string representation of DN. This work is based on work published in IETF RFC 2253 [7]. A DN string representation using the string encoding scheme specified in this document is also a valid DN string according the IETF RFC.

The string encoding scheme specified in this document imposes further restrictions as compared to the RFC. The most important restrictions are:

- Multi-valued RDN is not supported in the subject name convention.
- Character star ('*', ASCII 42) is used to denote wildcard in the subject name convention.

7.1 Converting DN from ASN.1 to a String

The following clauses define the algorithm for converting from an ASN.1 structured representation to string representation.

7.1.1 Converting `RDNSequence`

If the `RDNSequence` is an empty sequence, the result is the empty or zero length string.

Otherwise, the output consists of the string encoding of each `RDN` in the `RDNSequence` (according to subclause 7.1.2), starting with the first element of the sequence and moving forward toward the last element.

The encoding of adjacent RDNs are separated by a comma character (“,”, ASCII 44), to be consistent with IETF RFC 2253 [7].

White spaces adjacent to the slash character shall be ignored.

7.1.2 Converting `RelativeDistinguishedName`

When converting from an ASN.1 `RDN` to a string, the output consists of the string encoding of the singleton `AttributeTypeAndValue` (according to subclause 7.1.1).

Although X.500 DN supports multi-valued RDN, this specification supports single-valued RDN only.

7.1.3 Converting `AttributeTypeAndValue`

The `AttributeTypeAndValue` is encoded as the string representation of the `AttributeType`, followed by an equals character ('=', ASCII 61), followed by the string representation of the `AttributeValue`.

If the `AttributeType` is published in Table 1: Example of RDN **`AttributeType`** Strings~~Table 1: Example of RDN **`AttributeType`** Strings~~ in Appendix A, then the type name string from that table is used. If the `AttributeType` is not in the published table, implementation is free to use any string as long as the string does not begin with "IRP".

Although X.500 ASN.1 `AttributeValue` and `AttributeType` support wide range of character representation, this specification supports a restrictive set of characters according to subclause 7.2.

String representation of `AttributeValue` allows character escape mechanism such as the use of a backslash followed by two hex digits to replace a character in a string. String representation of `AttributeType` does not allow character escape mechanism.

Example: "`CN=Before\0DAfter,O=Test,C=GB`. In this example, the backslash and the two hex digits form a single byte in the code of the escaped character. The backslash, followed by "0D", indicates a carriage return. See Appendix B for a rule for MO designers to avoid ambiguity concerning the `AttributeType` of a DN string.

7.2 Character Syntax

This subclause specifies the character syntax for `AttributeType` and `AttributeValue`.

They are:

1. Any character except <special> where <special> is

   ",", "=", <CR>, <LF>, "+", "<", ">", "#", ";", "\" or """

2. The dot character ('.', ASCII 46). This character shall be used in the `AttributeValue` whose `AttributeType` is "DC". An example is "`DC=lme.companyZ.se`". This dot character shall not be used in `AttributeType`.

3. The star character ('*', ASCII 42) is reserved to denote wild card. Wild card character(s) can appear in `AttributeType` and `AttributeValue`.

7.3 BNF of DN String Representation

The following is the BNF for DN in string representation (Backus-Naur Form is popular in IETF specifications to define format syntax. See [10] for more information):

```
DistinguishedName := RDNSequence
<spaced-separator> ::= <optional-space> <separator> <optional-space>
<separator> ::=  ","
<optional-space> ::= ( <CR> ) *( " " )
RDNSequence := RDNSequence <spaced-separator>
    RDNSequence | RelativeDistinguishedName
RelativeDistinguishedName := AttributeTypeAndValue
AttributeTypeAndValue := AttributeType "=" AttributeValue
<special> ::= "," |"=" |<CR> |<LF> |"+" |"<" |">" |"#" |";" |"\" | """
AttributeType := <one or more StringChar>
AttributeValue := <one or more StringChar>
StringChar := any character except <special>
```

7.4 Maximum size of DN string

The maximum length of a DN string, including RDN separators and including white spaces, shall not exceed 400 bytes (8-bit).

8 Examples

This subclause gives a few examples of DN written in the string representation specified in this document.

1. "DC=com,DC=CompanyXYZ,DC=Marketing,IRPAgent=ATMPVCBilling,Log=19990101131000,AccountingRecord=100098". In this example, the name space aligns with DNS. The AttributeType of the top three RDN are "DC". Concatenation of the corresponding AttributeValues produces the DNS registered name, i.e. "marketing.companyXYZ.com". The top RDN is the Global Root because DNS defines "DC=com" as the root of its name space. That top RDN is the Local Root as well.

2. "DC=marketing.CompanyXYZ.com,IRPAgent=ATMPVCBilling,Log=19990101131000,AccountingRecord=100098". In this example, the name space aligns with DNS as well. Instead of using three RDNs to represent the DNS registered name, this example chooses to use one RDN. The top RDN is the Global Root (and Local Root as well).

3. "IRPNetwork=ABCNetwork,Subnet=TN2,BSS=B5C0100". In this example, the name space designer chooses not to name its objects under the DNS nor X.500 scheme. The name space designer chooses to use "IRPNetwork=ABCNetwork" as the Local Root of its name space (by looking at the DN string, it is not possible to say if the Local Root is the Global Root). DNs in this name space will start with that string as their Local Root. One string ("IRPNetwork") for AttributeType (of the AttributeTypeAndValue of the RDN) starts with "IRP". This indicates that this string is mapped from the MO class names specified in NRM of [9]. Other strings do not start with "IRP", indicating that those strings are not mapped from MO class names specified in NRM of [9]. They are probably mapped from MO classes that are specific for a particular product and thus specified in a product-specific NRM (MIM).

4. The following example illustrates the use of "," as separator for RDNs. It also illustrates the use of space and period as part of the legal character syntax for RDNs.

   CN=John T. Mills, O= Cyber System Consulting, L= Göteborg, C=SE

9 Usage Scenario

9.1 DN prefix usage

This subclause presents recommended steps designer uses to partition the Enterprise name space while building an Alarm IRP compliant NE (the Alarm IRP Agent).

1. The NE designer specifies the NRM [9] for the NE. Suppose the NRM is a two level hierarchy with 3 classes like:

```
Node
  |----- Port
  |----- CrossConnect
```

2. The NE designer, based on the NRM and other design choices, decides that there are 7 instances within the NE that can report alarms, such as
`Port=1, Port=2, Port=3, Port=4, Port=5, CrossConnect=1, Node=1.`
3. The NE designer decides on the DN prefix (see Appendix C) and configures its system accordingly. Since NE designer will not know the customer's name space in advance, he would normally configure the DN prefix to reflect his test environment. The DN prefix can be configured to "`Network=test`". The Global Root is "`Network=test`". The Local Root is "`Node=1`". Note that NE should not hard code the DN prefix but should treat DN prefix as a system configuration parameter, settable, for example, at system start-up time.

4. When constructing the alarm record (in coding phase), NE designer must concatenate the name of the alarmed instance with the DN prefix to form the DN of his test environment. The resultant DN (e.g., "`Network=test,Node=1,Port=3`") will be placed in the `Managed Object Instance` (`MOI`) field of the alarm record.

5. The NE is sold to a customer. The customer administrator knows his Enterprise name space, the topology of his network and where the NE will be deployed. Based on the information, he configures the DN prefix of the NE. For example, the customer administrator can configure it to:

   "`DC=CompanyXYZ.com,Net=DS3BackBone,Station=TMR`".

   The Global Root in this case is "`DC=CompanyXYZ.com`".

6. At run time, whenever NE is reporting an alarm on `Port=3` via the IRP, the following string will be in the `MOI` field of the alarm record.

   `"DC=CompanyXYZ.com,Net=DS3BackBone,Station=TMR,Node=1,Port=3".`

Appendix A: Mapping of RDN AttributeType to Strings

AttributeType of RDN are mapped into strings for use in the DN string representation. This appendix specifies the mapping.

The AttributeType shall include all MO classes defined in the Network Resource Model (NRM) of [9].

There is one AttributeType that is not defined in NRM of [9]. This special AttributeType is used to denote the domain component of the DNS. The following partial DN string representations are examples to illustrate the valid use of "DC" strings for the three DNS domain components of "lme.companyZ.se".

- DC=se.companyZ.lme,..
- DC=se,DC=companyZ,DC=lme,..
- DC=se,DC=companyZ.lme,..
- DC=se.companyZ,DC=lme,..

Table 11: Example of RDN AttributeType Strings

String	AttributeType
DC	Domain component of DNS
Network	MO class name Network defined in NRM of [9].
ManagedElement	MO class name ManagedElement defined in NRM of [9].
Cell	MO Class name Cell defined in NRM of [9].
etc.	Other MO class names as defined in NRM or product-specific NRM (extension to standard NRM).

Appendix B: Rule for MO Designers regarding `AttributeType` interpretation

This appendix discusses the two possible interpretations for the `AttributeType` of the DN string and recommends a rule for MO designers to avoid ambiguity concerning its usage. It identifies the protocol environment(s) under which each interpretation functions. It then recommends a rule for designing MO classes such that one DN string, regardless of protocol environment (therefore, regardless of interpretation used), will result in the unique reference to the identical network resource.

First interpretation

ITU-T X.500 uses the `AttributeType` (defined for use as the first component of the `AttributeTypeAndValue` of a RDN, see subclause 3.1.6) to identify one attribute of the subject MO for naming purpose. This `AttributeType` is called the *naming attribute* to distinguish itself from other attributes that may be present in the MO.

Suppose the following is the MO class definition in pseudo notation and this MO class is inherited from root.

```
Class Bsc {
 Attribute id;
 Attribute ..}
```

Suppose further that the naming attribute is `id`.

If this (first) interpretation is used for constructing the DN string, then the DN will be "…,`id=123`". MO class name cannot be derived from the DN string. The value of the `AttributeValue` contains the value of the naming attribute.

Second interpretation

In CORBA protocol environment, it is preferable to use the following interpretation.

The `AttributeType` (defined for use as the first component of the `AttributeTypeAndValue` of a RDN) is used to identify the MO class.

If this interpretation is used for constructing the DN string, then the DN will be "…,`Bsc=123`". The name of the naming attribute cannot be derived from the DN string. The value of the `AttributeValue` contains the value of the naming attribute.

Rule

Given the two interpretations, a DN reader cannot know how to interpret the `AttributeType`, i.e., if the `AttributeType` identifies class or naming attribute. To avoid ambiguity, the following rules shall apply:

- If `AttributeType` of a naming attribute is not a concatenation of MO class name and "Id", then the DN writer shall use "…,yyy.zzz =123,.." where "yyy" is the MO class name and "zzz" is the naming attribute. For example, if "`Bsc`" is the MO class name and if its naming attribute is "`SerialNumber`", then the DN shall be ",,,`Bsc.serialNumber`=123,..".
- If `AttributeType` of a naming attribute is a concatenation of MO class name and "Id", then the DN writer shall use "..,xxx=123,.." where "xxx" is the MO class name. For example, if "`Bsc`" is the MO class name and if its naming attribute is "`BscId`", then the DN shall be ",,,`Bsc`=123,..".

Appendix C: DN Prefix and Local Distinguished Name (LDN)

A Distinguished Name (DN) is used to uniquely identify a MO within a name space. A DN is built from a series of "name components", referred to as Relative Distinguished Names (RDNs).

DNs within a name space are arranged in hierarchy similar to concepts of naming files in UNIX file system. A file name, in the context of a local subdirectory, contains the path (series of subdirectory names) of the file starting from the local subdirectory. The same file, in the global context, contains the path of the file starting from the root directory. Similar concept applies to naming MOs. From a particular (local) context, the name of a MO is the Local Distinguished Name (LDN). From a global context, the name of the same MO is the DN. LDN is a proper subset of DN. In the context of a particular local context, a DN prefix is defined such that all LDNs in that particular context, if attached behind the DN prefix of that context, will yield the DNs of the MOs.

The concepts of DN Prefix and LDN support the partitioning of large name space into smaller ones for efficient name space implementation. DN design, the subject of this document, does not depend on these concepts. There exist other concepts that support partitioning of large name space as well. Although these concepts are independent from DN design, their use is wide spread and this appendix illustrates their use in partitioning large name space.

In modern network management, it is expected that the Enterprise name space be partitioned for implementations in multiple hosts. The following are reasons for the partitioning.

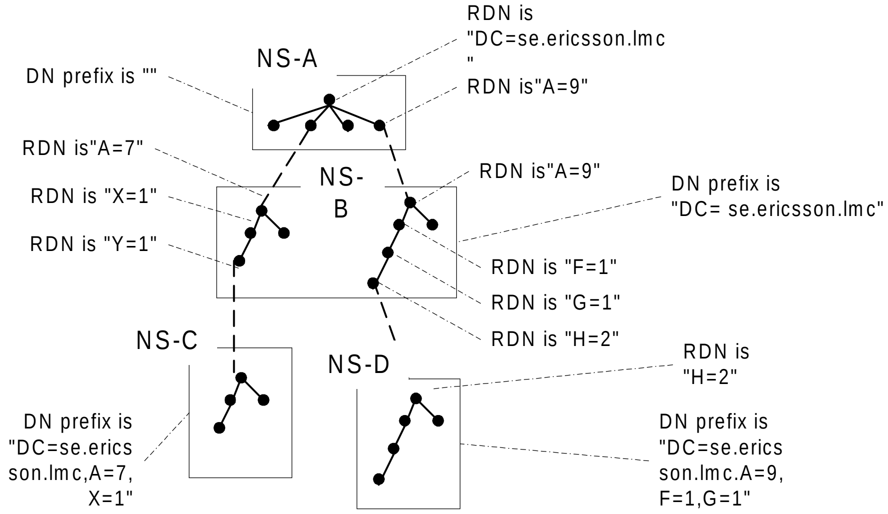
- The Enterprise name space can be large (e.g., containing millions of objects). Partition of a large name space facilitates name space management. For example, it may be easier to manage two name spaces of 1 million objects each than to manage one name space with two million objects.

- Separate IRPAgents manage sub-set of the Enterprise name space relevant to their own local environment. For example, one NE manages a name space (subset of the Enterprise name space) containing names of its MOs representing its own network resources. Another NE manages another sub-set, etc.

- For reasons such as security, replication, back-up policy and performance, sub-sets of the Enterprise name space are managed by separate systems. For example, Operation and Marketing departments may want to manage their name spaces using their respective management policies. Partitioning of Enterprise name space according to departmental jurisdiction may facilitate deployment of independent management policies.

Suppose the Enterprise name space is organized hierarchically and is partitioned into 4 sub-sets as shown in the following figure.

Figure 22: Name space partitions



NS (name space)-A contains 5 objects. DN prefix is NULL. The Global Root and Local Root of NS-A is "`DC=se.companyZ.lmc`" (see [*] below). DN of top object is "`DC=se.companyZ.lmc`". RDNs of the other four objects are, from bottom left to bottom right, "A=1", "A=7", " A=3" and "A=9". DNs of the same four objects are "`DC=se.companyZ.lmc,A=1`", "`DC=se.companyZ.lmc,A=7`", "`DC=se.companyZ.lmc,A=3`" and "`DC=se.companyZ.lmc,A=9`". The second and fourth objects are reference objects to MOs in NS-B.

NS-B contains two branches. They have the same DN prefix that is "`DC=se.companyZ.lmc`". The Global Root is "`DC=se.companyZ.lmc`".

The Local Root and RDN of top object of the right branch is "`A=9`". Its DN is "`DC=se.companyZ.lmc,A=9`". RDNs of other objects are shown in the figure. DN of the bottom object is "`DC=se.companyZ.lmc,A=9,F=1,G=1,H=2`". This object refers to object of another name space called NS-D.

The Local Root and RDN of the top object of the left branch is "`A=7`". Its DN is "`DC=se.companyZ.lmc,A=7`". RDNs of other objects are shown in the figure. DN of the bottom object is "`DC=se.companyZ.lmc,A=7,X=1,Y=1`". This object refers to object of another name space called NS-C.

NS-C contains a branch of 4 objects. Its DN prefix is "`DC=se.companyZ.lmc,A=7,X=1`". The Local Root an RDN of the top object is "`Y=1`".

NS-D contains a branch of 5 objects. Its DN prefix is "`DC=se.companyZ.lmc,A=9,F=1,G=1`". The Local Root and RDN of the top object is "`H=2`".

In the above figure, the bottom object of NS-B right branch has the following names:

- DN is "`DC=se.companyZ.lmc,A=9,F=1,G=1,H=2`".
- LDN is "`A=9,F=1,G=1,H=2`".
- RDN is "`H=2`".

With this example, we can see that DN of an object is a series of RDNs spanning the global name space. LDN of an object is a series of RDNs spanning the local name space where the subject MO resides.

The concatenation of the LDN with DN prefix of that (partitioned) name space shall produce the DN of the global name space.[*] Use of "DC" in "DC=se.companyZ.lmc" is an attempt to align the RDN with DNS name associated with the named organisation. The "DC" stands for domain component and is an attribute name defined by IETF for use in directory work. Appendix A specifies other valid ways to align RDN with DNS as well. Equally valid, the example can choose to align the RDN with the X.500 convention. In such case, the subject string can be "C=se,O=CompanyZ,L=lmc" where C, O and L are X.500 standard attributes denoting country, organisation and location respectively. The alignment choice belongs to the name space designer of the customer who purchases our products. The choice will be reflected in the value of the DN prefix, probably a product configuration parameter. See Clause 7 for more information.

Annex A (informative): Change history

Change history					
TSG SA#	Version	CR	Tdoc SA	New Version	Subject/Comment
S_07	2.0.0	-	SP-000012	3.0.0	Approved at TSG SA #7 and placed under Change Control
Post S5#10S_04	3.0.03.0.0	-001	- S5-000227SP-99308	3.0.13.1.0	Updated by MCC staff with editorial changes according to documentation rules.Mechanism for data integrity of signalling messages
S_S5#11 S_04	3.0.13.0.0	-002	?SP-99308	3.0.1a3.1.0	Updated according to S5#10bis (S5-000192) and S5#11 (decision to create separate parts for main body and earlier annexes). To be agreed at S5#11bis and approved at S5 #12, together with possible new updates according to S5#11bis.Description of layer on which ciphering takes place

SA5 internal Change history				
SA/SA5 meeting	**Version**	**Tdoc SA/SA5**	**New version**	**Subject/comment**
Post S5#11bis	3.0.1a	S5C000052	3.0.1b	First reviewed version. Updated according to agreements at meeting #11bis (including 32.106 split into 8 parts).
Post S5#12	3.0.1b	S5C000066	3.0.1c	Updated according to agreements at meeting #12