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Proposed ATN Naming and Addressing Extensions

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SUMMARY

This paper describes a number of proposed extensions to the upper layer naming and addressing provisions, to overcome some limitations identified for Package 2.

The Working Group is invited to approve these proposals.

1. INTRODUCTION

Ongoing ATN application concepts and developments have highlighted a number of restrictions in the CNS/ATM-1 upper layer naming and addressing, which may cause problems in future ATN Packages.

WG3/SG3 considered these problems at its meeting in Bracknell in April 1998, and arrived at the proposed solutions documented in this paper, which are now presented to the Working Group for consideration for inclusion in the next edition of the ATN technical provisions.

2. BACKGROUND

The current ATN naming hierarchy for Package 1 is illustrated in Figure 1 (taken from Sub-Volume 4).

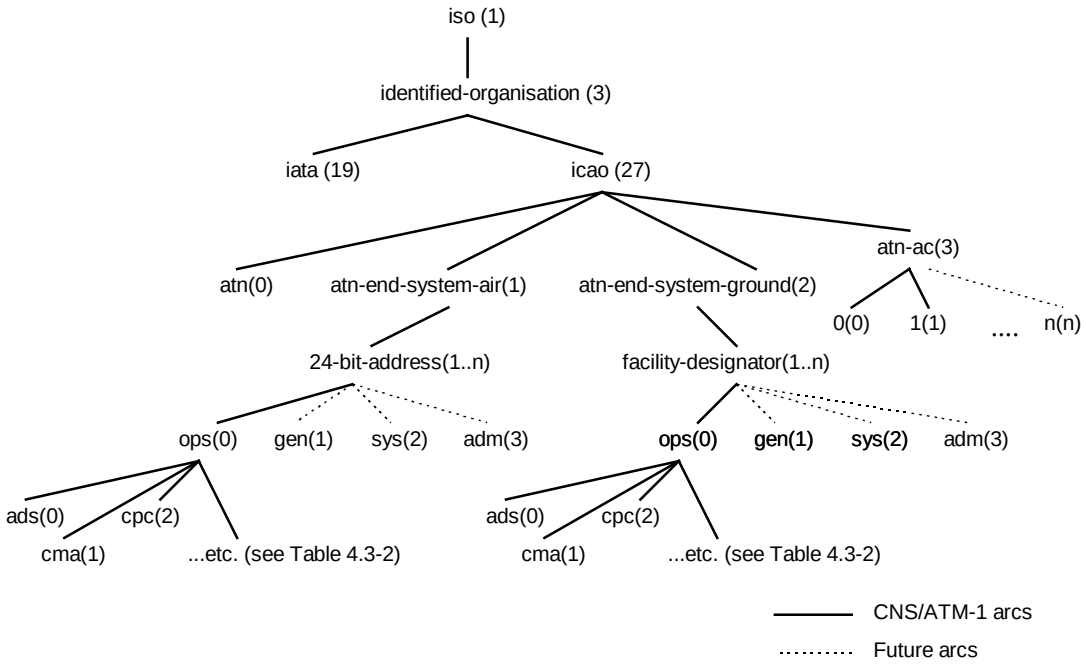


Figure 1. ATN Naming Hierarchy

Immediately under the ICAO arc, the values specified in Table 1 are used to specify the next level of the naming hierarchy.

In the CNS/ATM-1 architecture, Application Entities (AEs) reside on ATN end systems and each AE embodies the functionality of a single ATN application. Conversely, each ATN application corresponds to a single AE. AE Titles (AETs) are used to name CNS/ATM-1 ATN applications (such as Context Management), and these names are mapped to and from PSAP addresses by the ATN upper layers.

From Figure 1, the AE Title (AET) structure is defined as:

{iso (1).identified-organisation (3).icao (27).atn-end-system-air (1)[or ground (2)].<end-system-id>.operational (0).<ae-qualifier>}

AE Titles defined for the ATN AEs contain as a variable element the end system identifier (i.e. the 24-bit address for air AEs and the ICAO ground facility designation for ground AEs). That means that in an aircraft, only one AE of a given type can be addressed, not necessarily in the same physical system. This principle works a priori for all air-ground applications.

Table 1. Top-level ICAO Identifiers

Name and numeric value	Description
atn (0)	General ATN identifiers
atn-end-system-air (1)	ATN aircraft end systems. The following OID component beneath this arc is a 24-bit ICAO aircraft identifier
atn-end-system-ground (2)	ATN ground end systems. The following OID component beneath this arc is an ICAO facility designator
atn-ac (3)	ATN application context names

3. PROBLEM STATEMENT

A number of related problems are foreseen in Package 2 if the current upper layer naming and addressing provisions are not extended. These are considered in the following sub-sections.

3.1. Multiple application instances

Problems occur when there are applications which may have different instances simultaneously on different co-located systems. This is obviously the case of the System Management Application which may have one Agent per machine. So for example, in an aircraft installed with one BIS and one ES, the AET used by the ground manager should allow the identification of each airborne agent. With the current AET format, this is not possible.

The problem is similar for ground systems (several SM AEs may co-exist within a Ground Facility).

This is one aspect of a more general limitation, in that it is not possible to address explicitly multiple instances of any CNS/ATM-1 application in an ATN end system. There may be requirements in Package 2 for multiple CM applications (say) to exist in an aircraft.

3.2. Context Management limitations

It is inherent in the CM application protocol that there is only one address per application type, and that sub-arcs below AEQualifier in the naming hierarchy are not catered for. If a CM-Logon is performed to exchange further addresses, then previous addresses are overwritten.

The CM protocol restricts the AEQ to an integer in the range (0 .. 255), and this is not extensible (i.e. there is no extensions marker in the ASN.1 definition). (The type is called AEQualifier in the CM technical provisions - APName in earlier drafts).

3.3. Alternative naming domains

ATN Routers and some End Systems may have identifiers taken from alternative name spaces (i.e. neither the 24-bit aircraft address nor the ICAO Facility Designator apply). In such cases the name-address mapping specified in the ULCS SARPs will break down. This may happen when trying to communicate with SM Agents in Routers, for example.

3.4. Problem Summary

To summarise, the following issues need to be solved for Package 2:

a) Package 1 ATN naming and addressing does not handle multiple instances of the same application type

b) CM does not allow for naming arcs below AEQualifier

c) Routers can have names from different naming trees

d) How to register additional AE types, either ICAO or external (e.g. CTS, SAM)

It is required that the solution shall be compatible with CNS/ATM-1.

4. DISCUSSION

In general, if there were different instances of the same application on the same end system, then this could be catered for by using Invocation Identifiers in the addressing. However, if there are multiple system management agents in an ATN end system, with each responsible for a different set of MOs, then arguably they are not 'the same application' and would need distinguished addresses. But we should not expect the ground system to know the systems management configuration of the aircraft. There could for example be a single Agent acting as a proxy for ALL airborne management information.

It would be possible to extend the ATN UL naming for systems management by allocating additional AE qualifiers for SMA (currently only the single value 5 is allocated). But is this really a requirement?

It might be possible to extend the syntax of the AEQ, for example to redefine it as a sequence of INTEGER. However, ACSE requires the AEQ to be either an X.500 Relative Distinguished Name, or a single unconstrained INTEGER (and in CNS/ATM-1, only the latter form is valid).

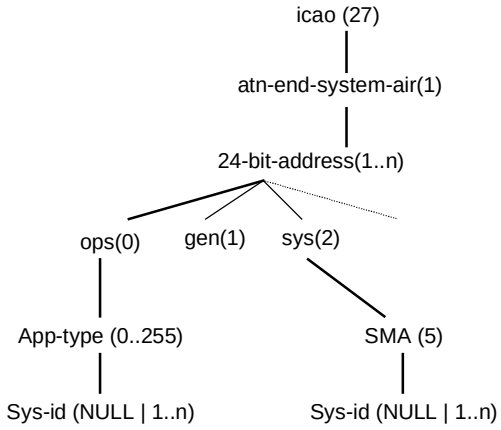
5. PROPOSED SOLUTION

For CNS/ATM-1, it is assumed that there is a single addressable ATN End System per aircraft and per ICAO-identified facility, and that these are the only End Systems. The proposed solution for Package 2 removes these restrictions yet retains backwards compatibility with the CNS/ATM-1 architecture.

In effect, the proposal is to re-define the Application Process (AP) to be what was previously the Application Entity (AE), so that now an AP Title identifies a given application type in a given location, rather than just identifying the location. The AE Title is redefined such that it now identifies a given application type on a specific End System within that location.

It is therefore proposed for Package 2 to add a further arc to the naming tree, subordinate to what was previously the AEQ field. It is proposed that this additional arc shall be either NULL (for Package 1 compatibility) or an unambiguous End System identifier, called "Sys-id" in the following discussion.

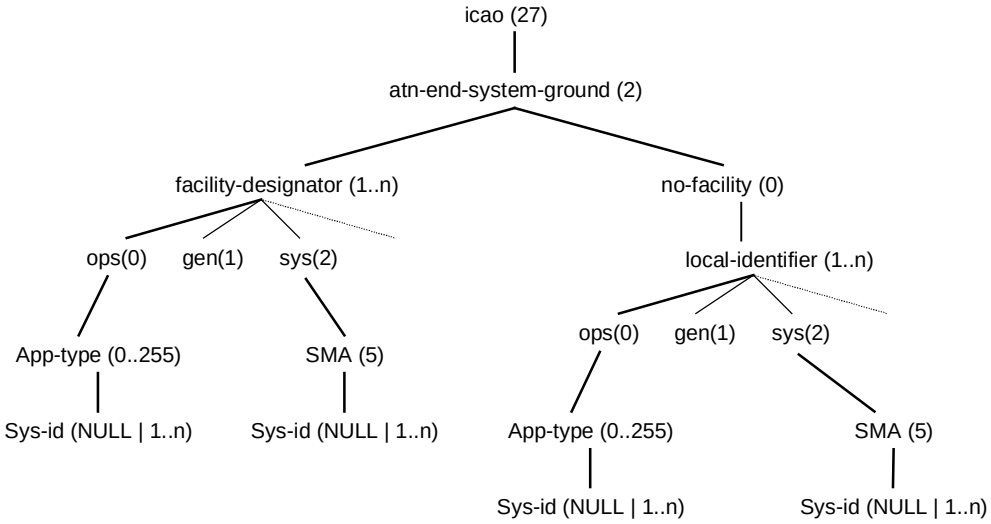
This has the effect of further qualifying the AET for a given facility or aircraft. This is illustrated for airborne systems in the following diagram.



Here, the "app-type" arc is the AEQ, as used in Package 1 (i.e. ads (0), CMA (1), cpc (2), etc.). The new arc is "sysid", which can either be NULL, for Package 1 compatibility, or a System Identifier, an INTEGER in the range 1 to some undefined upper limit.

For Package 2, it is also proposed that new use is made of the "sys" arc or the naming tree for system management applications.

For ground systems, it is recognised that not all addressable ATN elements will have an associated ICAO facility designator. Thus a new arc subordinate to atn-end-system-ground is proposed. This is illustrated below:



Here, the left-hand side of the naming tree (under facility designator) is the same as for airborne systems. However, a new sub-tree is proposed (identified as no-facility (0)) for cases where the ground system does not possess an ICAO facility designation. In such cases, a local identifier is used to name the system. Values of local identifier must be unambiguous, and a registration authority will be required to ensure this.

5.1. Format and encoding of the Sys-id

It is proposed that the Sys-id described above should be identical to the System Identifier used in the ATN NSAP address (the SYS field).

Sub-Volume 5 defines the value of the System Identifier (SYS field) to be a unique binary number assigned by the addressing authority responsible for the Network Addressing Domain that corresponds with the Routing Area in which the identified system is located. For example, if the System is attached to an IEEE 802 Local Area Network (such as an Ethernet), then a common approach is to use the 48-bit LAN address as the value of the SYS field. In an ATN NSAP address or NET, the System Identifier (SYS field) is six octets in length.

The Sys-id will be conveyed by ACSE as the AE Qualifier (AEQ) in the called and calling name fields of A-ASSOCIATE primitives. ACSE requires that this field be either an INTEGER or a Relative Distinguished Name. For CNS/ATM-1 compatibility, the INTEGER form must be used.

Thus, the 6-octet value of the SYS field shall be encoded as a (large) ASN.1 INTEGER.

5.2. How will this work in practice?

5.2.1. CM Logon data

The CM Logon exchange will continue to be used as in CNS/ATM-1. The AEQ values exchanged shall be deemed to be the current operational ATS version of applications only (NULL beneath the AEQ arc in the naming tree).

To avoid confusion, the AEQualifier in the CM technical provisions could be re-named APType.

5.2.2. System Management Agent addressing

For the system management application, the AE Title structure is defined as:

{iso (1).identified-organisation (3).icao (27).atn-end-system-air (1)[or ground (2)].<end-system-id>.sys (2).SMA (5).Sys-id}

That is, the Sys-id becomes the AEQ, and is conveyed as such by the ACSE A-ASSOCIATE service.

The DS-User will specify the called end-system-id in the D-START request, as for Package 1. In addition, the DS-User will be able to specify a Sys-id, to disambiguate the addressed SMA in cases where there is more than one SMA in an aircraft or ground facility.

5.2.3. Airborne application addressing

To identify an application in an airborne system, the AE Title structure is defined as:

{iso (1).identified-organisation (3).icao (27).atn-end-system-air (1). <end-system-id>.ops (0).App-type.Sys-id}

That is, the Sys-id becomes the AEQ, and is conveyed as such by the ACSE A-ASSOCIATE service. Where the sender does not specify a Sys-id, then the receiving system assumes that the current active ATS invocation of the application is being addressed (in Package 1, this defaults to the only invocation of the application).

The DS-User will specify the called end-system-id in the D-START request, as for Package 1. In addition, the DS-User will be able to specify a Sys-id, to disambiguate the addressed application in cases where there is more than one instance of that application type in an aircraft.

5.2.4. Ground application addressing at ICAO designated facilities

To identify an application in a ground system which has a registered ICAO facility designator, the AE Title structure is defined as:

{iso (1).identified-organisation (3).icao (27).atn-end-system-ground (2).<end-system-id>.ops (0).App-type.Sys-id}

That is, the Sys-id becomes the AEQ, and is conveyed as such by the ACSE A-ASSOCIATE service. Where the sender does not specify a Sys-id, then the receiving system assumes that the current active ATS invocation of the application is being addressed (in Package 1, this defaults to the only invocation of the application).

The DS-User will specify the called end-system-id in the D-START request, as for CNS/ATM-1. In addition, the DS-User will be able to specify a Sys-id, to disambiguate the addressed application in cases where there is more than one instance of that application type in a ground facility.

5.2.5. Ground application addressing at non-ICAO designated facilities

To identify an application in a ground system which does not have a registered ICAO facility designator, the AE Title structure is defined as:

{iso (1).identified-organisation (3).icao (27).atn-end-system-ground (2).no-facility (0).<local-identifier>.ops (0).App-type.Sys-id}

That is, the AET includes an name (local-identifier) which identifies the ground station unambiguously. Sys-id becomes the AEQ, and is conveyed as such by the ACSE A-ASSOCIATE service. Where the sender does not specify a Sys-id, then the receiving system tries to map the address to an invocation of the application. If thi is not possible then an error will be reported.

The DS-User will specify the called local-identifier in the D-START request. In addition, the DS-User will be able to specify a Sys-id, to disambiguate the addressed application in cases where there is more than one instance of that application type in a ground facility.

5.2.6. Called PSAP Address known a priori

If the calling application has prior knowledge of the Presentation Address of a destination application, then the name-address mapping mechanism of the CF can be by-passed by allowing the address to be specified directly in the D-START request.

5.3. Proposed changes to Dialogue Service for Package 2

As a consequence of the naming extensions described abobe, it is proposed for Package 2 to add a new optional field to the D-START service to allow the Sys-id to be specified.

The CNS/ATM-1 Dialogue Service in Sub-Volume 4 requires that the destination end system be specified as either an ICAO facility designator or a 24-bit aircraft identifier. There are some cases where the entity to be addressed does not fit into this scheme. Therefore it is proposed to extend the addressing fields in the D-START primitives to allow a full presentation address to be optionally specified.

The proposed changes for Package 2 are summarised in the following table.

Parameter	Package 1	Package 2

Parameter	Package 1	Package 2
D-START Called Peer ID	Mandatory parameter in D-START, used by the CF to look up the called PSAP address, which is used in the A-ASSOCIATE request. The Called Peer ID is either an ICAO facility designator or a 24-bit aircraft identifier, and is not conveyed to the peer.	Optional parameter in D-START. If present, used by the CF as part of the look up of the called PSAP address, which is used in the A-ASSOCIATE request. If not present, the DS-User must specify the called PSAP address directly. The Called Peer ID is either an ICAO facility designator or a 24-bit aircraft identifier.
D-START Calling Peer ID	Optional parameter. If present, the CF uses it to build the calling AP Title and Calling AE-Qualifier, which are used in the A-ASSOCIATE request. If absent, these ACSE parameters are not used. When an A-ASSOCIATE indication is received, the Calling Peer ID is extracted from the Calling AP Title parameter, if present, and presented to the receiving DS-User. The Calling Peer ID is either an ICAO facility designator or a 24-bit aircraft identifier.	Optional parameter. If present, the CF uses it to build the calling AP Title, which is used in the A-ASSOCIATE request. If absent, this ACSE parameter is not used. When an A-ASSOCIATE indication is received, the Calling Peer ID is extracted from the Calling AP Title parameter, if present, and presented to the receiving DS-User. The Calling Peer ID is either an ICAO facility designator or a 24-bit aircraft identifier.
D-START Called Sys-id	Not supported in Package 1	Optional parameter in D-START. If present, then the Called Peer ID must also be present. Used by the CF as part of the look-up of the called PSAP address, which is used in the A-ASSOCIATE request. If absent, then any instance of this AP at the addressed location is being addressed. If absent, the DS-User must specify either the Called Peer ID as above, or the called PSAP address directly.

Parameter	Package 1	Package 2
D-START Calling Sys-id	Not supported in Package 1	Optional parameter in D-START. If present, then the Calling Peer ID must also be present. If present, the CF uses it to build the calling AE Qualifier, which is used in the A-ASSOCIATE request. If absent, this ACSE parameter is not used. When an A-ASSOCIATE indication is received, the Calling Sys-id is extracted from the Calling AE Qualifier parameter, if present, and presented to the receiving DS-User.
D-START Called Presentation Address	This Mandatory ACSE parameter is not available to the DS-User. Inserted by CF lookup operation.	Optional parameter in D-START. If present, used by the CF as the Called PSAP address in the A-ASSOCIATE request. If not present, the DS-User must specify the Called Peer ID (and optionally the Called Sys-id).
Calling Presentation Address	This Mandatory ACSE parameter is inserted by the CF, based on local knowledge of where the system is running.	Same as Package 1
Called AP Title, Called AE Qualifier, Responding AP Title and Responding AE Qualifier	These A-ASSOCIATE parameters are not used.	Same as Package 1
Called, Calling and Responding Invocation Identifiers	These A-ASSOCIATE parameters are not used.	Same as Package 1

To further clarify the proposal, the abstract syntax of the called name and address D-START parameters is shown below, using ASN.1 notation.

```
-- The type CalledNameOrAddress could be used as the Called Peer ID
-- parameter of the D-START service.

CalledNameOrAddress ::= CHOICE {
     name           [1] CalledPeerId,
     address        [2] TransportAddress -- specified elsewhere
}
```

```
CalledPeerId ::= SEQUENCE {
     locationID     [1] LocationType,
     sysID          [2] INTEGER  OPTIONAL,
     …
}

LocationType ::= CHOICE {
     aircraft       [1] AircraftID, -- 24-bit address
     groundFacility[2] FacilityDesignation, -- ICAO designator
     general        [3] LocalIdentifier,
     …
}
```

5.4. Compatibility Considerations

It is a key requirement of these proposed upper layer naming and addressing extensions that backwards compatibility with CNS/ATM-1 shall be maintained.

When establishing an association between a Package 1 application and a Package 2 application, there will be one fewer component in the Application Entity Title of the former. However, this will not cause any interworking problems, as the Called AE Title is not conveyed to the peer system.

If a Package 2 DS-User addresses a Package 1 application, and uses the Calling Peer ID parameter, then Package 1 implementations will receive one more component than expected in the Calling AP Title parameter of ACSE. Also, the Calling AE Qualifier parameter value will not have one of the expected values. Thus, a CNS/ATM-1 CF implementation which performs rigorous checking of these parameters will have problems. There is a risk that less rigorous implementations may incorrectly decode the Calling AP Title and thus present an invalid Calling Peer ID value to the receiving DS-User. This may in turn cause interoperability problems if there are cases where the Calling Peer ID is validated to check that the caller is a known 24-bit address or ICAO facility designator.

If a Package 1 system addresses a Package 2 system which has more than one invocation of the addressed application type, then there could be some ambiguity as to which invocation should respond. There would need to be a pre-defined default responder.

6. CONCLUSION

This paper presents a number of proposed extensions to the ATN upper layer naming and addressing for Package 2, to allow a number of identified user requirements to be met. The proposed changes are limited in scope to Sub-Volume 4, and are designed to ensure backwards compatibility with the published CNS/ATM-1 provisions.

The Working Group is invited to review these proposals and confirm that they satisfy all the identified requirements in a coherent and workable fashion.