EUROCONTROL

ATNP/WG3/WP **14-11**

15 September 1998

AERONAUTICAL TELECOMMUNICATION NETWORK PANEL

WORKING GROUP 3 (APPLICATIONS AND UPPER LAYERS)

Bordeaux, France, 29 September - 2 October 1998

Proposed ATN Upper Layer Naming and Addressing Extensions

Prepared by: WG3/SG3 (Upper Layer Architecture)

Presented by: Tony Kerr

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.

This is a revision of WG3/WP13-11, which was presented in Utrecht.

The Working Group is invited to approve these proposals.

Contents

1. INTRODUCTION

The ongoing development of ATN application concepts and implementation programmes have highlighted a number of restrictions in the CNS/ATM-1 upper layer naming and addressing, which may cause problems in future ATN applications and implementation architectures.

These have been raised in PDR 97120001, which was Forwarded by the ATNP CCB to WG3 and thence to SG3 for resolution. WG3/SG3 considered these problems at its meeting in Bracknell in April 1998, and arrived at the proposed solutions documented in WG3/WP13-11, which were presented to the Working Group at its Utrecht meeting in June - July 1998.

Following constructive comments from the WG, and further discussions in WG3/SG3 at its meeting in Toulouse in September 1998, the concepts have been refined and 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 Application Entity Titles (AETs) is illustrated in Figure 1 (taken from Sub-Volume 4).

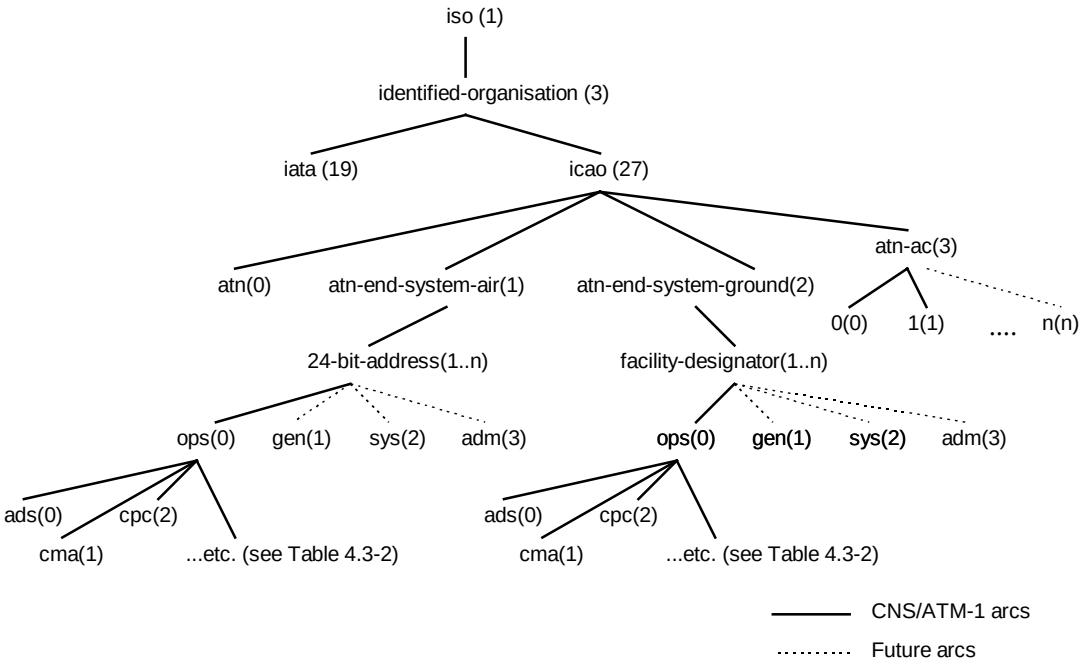

Figure 1. ATN Naming Hierarchy (Fig 4.3-2 from Doc. 9705)

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

In the current architecture, Application Entities (AEs) reside on ATN end systems and each AE embodies the functionality of a single ATN application (such as ADS or CPDLC). Conversely, each ATN application corresponds to a single AE. AE Titles (AETs) are used to

name such ATN applications, and these names are mapped to and from PSAP addresses by the ATN upper layers.

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

From Figure 1, the AET syntax is an ASN.1 OBJECT IDENTIFIER type, with the following structure:

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

The AE-qualifier value represents the application type, and values are pre-assigned (i.e. registered) in Sub-Volume 4 (e.g. 0 for ADS, 1 for CM, 5 for the Systems Management Application, etc.).

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 or an ICAO-designated ground facility, only one AE of a given type can be addressed, even if there are multiple physical systems at that location. This principle works a priori for all air-ground applications.

3. PROBLEM STATEMENT

A number of related problems are foreseen in the future 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.

For example there is clearly a problem for the System Management Application, which may have one Management Agent per physical machine. On an aircraft installed with one BIS and one ES, for example, a Manager application must be able to identify unambiguously each airborne agent. With the current AET format, this is not possible. The problem is similar for ground systems, where several SM AEs may co-exist within a single ground facility.

This is one aspect of a more general limitation, in that it is not currently possible to address explicitly multiple instances of any application in an ATN end system. There may be requirements in the future for multiple CM applications (say) to exist in an aircraft.

3.2. 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.

3.3. Requirements Summary

To summarise, the following issues need to be resolved in a future revision of the ATN technical provisions:

a) ATN naming and addressing shall handle multiple instances of the same application type at a given location. (Requirement source: ATNP system management, IATA verbal inputs).

b) ATN upper layers shall handle AET names from name spaces other than the ICAO naming tree. (Requirement source: ATNP system management, observation that not all ATN systems are located at ICAO-designated facilities).

c) A means shall be provided to register additional AE types, either ICAO or external (e.g. CTS, SAM). (Requirement source: ATN implementors, IATA verbal inputs).

It is required that the solution shall be backwards compatible with the first edition of ICAO Doc. 9705.

4. DISCUSSION

The OSI standards allow for different instances of the same application on the same end system, by means of Invocation Identifiers in the addressing. However, if there were 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.

Alternatively, it might 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 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 might be possible to extend the syntax of the AE-qualifier, for example to redefine it as a sequence of INTEGER. However, ACSE requires the AE-qualifier to be either an X.500 Relative Distinguished Name, or a single unconstrained INTEGER (and for ATN, only the latter form is currently valid).

4.1. Context Management constraints

It is inherent in the CM application protocol that there is only one TSAP (and hence PSAP, as session and presentation selectors are not used) address per application type. Sub-arcs below AEQualifier in the naming hierarchy are not catered for. If, after the initial CM-Logon exchange, a further CM-Logon were performed to exchange additional addresses, then previous addresses are overwritten.

The CM protocol restricts the AE-qualifier 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).

5. PROPOSED SOLUTION

The proposed solution comprises several parts:

a) extend the ATN naming hierarchy with additional arcs subordinate to application type

b) allow non-ICAO users use of Dialogue Service by allowing alternative forms of “Peer Id”.

5.1. Naming Tree Extensions

It is proposed for to add a new arc to the ATN naming tree (Figure 1), subordinate to what was previously the AE-qualifier field. It is proposed that this additional arc shall be either NULL (i.e. absent) for backwards compatibility, or an unambiguous End System identifier, called ”Sys-id” in the following discussion.

In effect, this would 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 then redefined such that it now identifies a given application type on a specific End System within that location.

It is also proposed that new use is made of the “sys” arc of the naming tree for system management applications.

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.

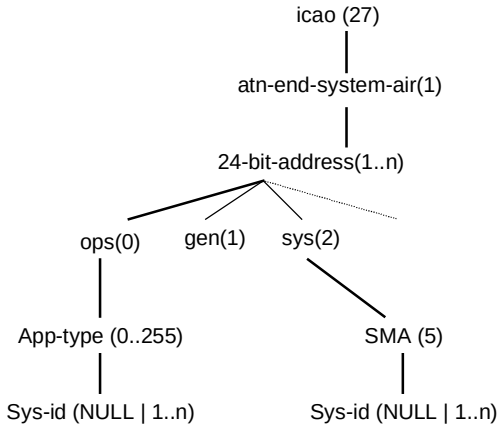

Figure 2. Proposed Naming Extensions (air)

Here, the “app-type” arc is the former AE-qualifier (i.e. ads (0), cma (1), cpc (2), etc.). The new arc is “Sys-id”, which can either be NULL, for backwards compatibility, or a System Identifier, an INTEGER in the range 1 to some undefined upper limit.

For ground systems, the identical change would apply subordinate to atn-end-system-ground(2).

5.2. Format and encoding of the Sys-id

It is proposed that the Sys-id described above should be the concatenation of the Location (LOC) and System Identifier (SYS) used in the ATN NSAP address.

The LOC field is a 2-octet value whose purpose is to distinguish routing areas within the same routing domain (RD). If more than one RD is located on a single aircraft, it

distinguishes each such RD and the routing areas contained within them. LOC values are assigned by the addressing authority for the RD containing the identified routing area.

The SYS field is a 6-octet value which is used to uniquely identify an ATN ES or IS within a given routing area. It is 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.

The 8-octet Sys-id will be optionally passed to ACSE as the Calling AE Qualifier of A-ASSOCIATE primitives, and will appear as calling-AE-qualifier in AARQ APDUs. ACSE requires that this field be either an INTEGER or a Relative Distinguished Name. For backwards compatibility, the INTEGER form must be used.

Thus, the 8-octet value of the LOC+SYS shall be encoded as a (large) ASN.1 INTEGER when required.

5.3. Format of Peer Identifier parameters

With the current Dialogue Service specification, a dialogue can only be established with a peer application which has a known (registered somewhere) 24-bit aircraft address or 8 character ICAO ground facility designator. This is a restriction in the Called-Peer-ID parameter of the D-START service.

It is proposed to extend the syntax of this parameter to allow a called PSAP address to be specified in place of the Called-Peer-ID, to cater for cases where:

a) an ATN system does not comply with the ICAO naming tree, and/or

b) the called PSAP address is known a priori.

5.4. How will this work in practice?

5.4.1. CM Logon data

The CM Logon exchange will continue to be used as at present. The “AE-qualifier” values exchanged in the CM protocol are actually AP type identifiers, and to avoid confusion, the AEQualifier in the CM technical provisions could be re-named APType.

For ATS applications (AP types CM, ADS, CPDLC, FIS) the addresses conveyed in the CM primitives shall be deemed to be the addresses of current operational ATS invocation of applications only (i.e. NULL beneath the AE-qualifier arc in the naming tree).

For the System Management application, the CM-User can communicate via the CM-Logon the addresses of <u>all</u> system management Agents at that location.

5.4.2. 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 AE-qualifier, and is optionally conveyed as such in the Calling AE Qualifier field of the ACSE A-ASSOCIATE service.

At the Dialogue Service boundary, the SMASE will specify the called end-system-id in the D-START request, as at present. 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.

5.4.3. 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 AE-qualifier, and is optionally conveyed as such in the Calling AE Qualifier field of the ACSE A-ASSOCIATE service.

The DS-User will specify the called end-system-id in the D-START request, as at present. 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.

Where the sender does not specify a Sys-id, then the address resolution mechanism assumes that the current active ATS invocation of the application is being addressed (currently, this defaults to the only invocation of the application).

5.4.4. 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 AE-qualifier, and is optionally conveyed as such in the Calling AE Qualifier field of the ACSE A-ASSOCIATE service.

The DS-User will specify the called end-system-id in the D-START request, as at present. 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.

Where the sender does not specify a Sys-id, then the address resolution mechanism assumes that the current active ATS invocation of the application is being addressed (currently, this defaults to the only invocation of the application).

5.4.5. Ground application addressing at non-ICAO designated facilities

If an application requires to start a dialogue with a peer application on a system at a ground location which does not have a registered ICAO Facility Designator, then it is not able to use the “Called Peer Id” parameter at the Dialogue Service boundary. Instead, the calling application will have to obtain the PSAP address of the peer by some local means, and proceed as defined in the following subsection.

5.4.6. 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 Dialogue Service can be by-passed by allowing the address to be specified directly in the D-START request.

5.5. Proposed changes to the ULCS Dialogue Service

The Dialogue Service as currently specified 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.

As a consequence of the naming requirements described above, it is proposed:

a) to add a new optional field to the D-START service to allow the Sys-id to be specified.

b) to extend the addressing fields in D-START primitives to allow a full presentation address to be optionally specified.

The proposed changes are summarised in the following table.

Addressing Parameter	**Current use**	**Modified use**
D-START Called Peer ID Syntax: either ICAO facility designator or 24-bit aircraft identifier	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 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. One and only one of Called Peer ID / Called PSAP address may be present in D-START.
D-START Calling Peer ID Syntax: either ICAO facility designator or 24-bit aircraft identifier	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.	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.
D-START Called Sys-id Syntax: 8-octet identifier (LOC+SYS)	Not supported	Optional parameter in D-START. Only valid if the Called Peer ID is present. 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 absent, then <u>any</u> instance of this AP at the addressed location is being addressed. .

Addressing Parameter	Current use	Modified use
D-START Calling Sys-id Syntax: 8-octet identifier (LOC+SYS)	Not supported	Optional parameter in D-START. Only valid if the Called Peer ID is 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 Syntax: ATN TSAP address	Not supported (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). One and only one of Called Peer ID / Called PSAP address may be present.
Calling Presentation Address	Not supported (This Mandatory ACSE parameter is inserted by the CF, based on local knowledge of where the system is running).	No change.
Called AP Title, Called AE Qualifier, Responding AP Title and Responding AE Qualifier	Not supported These Optional A-ASSOCIATE parameters are not used.	No change.
Called, Calling and Responding Invocation Identifiers	Not supported These Optional A-ASSOCIATE parameters are not used.	No change

To further clarify the proposed changes, 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] ATNTransportAddress -- specified elsewhere
}
CalledPeerId ::= SEQUENCE {
     locationID    [1] LocationType,
     sysID         [2] INTEGER  OPTIONAL,
     …
}
LocationType ::= CHOICE {
     aircraft      [1] AircraftID, -- 24-bit address
     groundFacility[2] FacilityDesignation, -- ICAO designator
     …
}
```

5.6. Registration Issues

5.6.1. Application Type Registration

Additional AE types, either ICAO-defined or external (e.g. CTS, SAM) may currently be registered only by proposing a modification to ICAO Doc. 9705, Table 4.3-2.

Registration is only a strict requirement for ATS applications which make use of the CM application to exchange address and version information over the air-ground data link. Such applications are specified by ATNP WG3, so this should not be an issue.

5.6.2. Sys-ID Registration

The Sys-ID proposed in this paper is composed of LOC and SYS components, both of which are registered by the ATN Network Addressing (Sub-) Domain Authority which contains the parent Routing Domain, as defined in Sub-Volume 5. The registration mechanisms are outside the scope of ATNP WG3.

5.6.3. Facility Designator Registration

An alternative solution for handling ground systems which have no registered ICAO facility designator, is to register them, according to the provisions of ICAO Docs. 7910 “Location Indicators” and 8585 “Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services”. This is beyond the scope of ATNP.

5.7. Compatibility Considerations

It is a key requirement of these proposed upper layer naming and addressing extensions that backwards compatibility with the first edition of ICAO Doc. 9705 shall be maintained.

For convenience in this section, the term “Package 1” indicates the current naming and addressing provisions, and the term “Package 2” indicates the naming and addressing provisions revised as proposed in this paper.

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 Package 1 CF implementation may have problems if it performs rigorous checking of these parameters.

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 revised paper presents a number of proposed extensions to ATN upper layer naming and addressing, 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 ATN technical 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.