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Working Group 2

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Proposed Guidance Material for Address Registration

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SUMMARY

This paper offers material on ATN address registration for inclusion into the Guidance Material of Subvolume 5 of the ATN SARPs. It is recommended that Working Group 2 reviews the proposed text and adopts its inclusion into the Subvolume 5 Guidance Material.

1. Introduction

The ATN naming and addressing scheme is based on the OSI Reference Model (ISO 7498-3) which supports the principles of unique and unambiguous identification of information objects and global address standardisation which are essential features for an international, mixed-user communications system as the ATN.

2. ATN Network Addressing Plan

A well defined network addressing plan has been established for the ATN which meets the needs of a variety of aeronautical data communication user groups, including ATS providers, airlines and international aeronautical communication service providers (IACSPs). Furthermore, it supports essential goals of ATN internal operation, such as efficient information reduction when exchanging address information (as part of the routing information) and unambiguous and complete address reconstruction from received address fragments (in the context management application).

In order to facilitate the address assignment and registration in the ATN, which is expected to comprise several thousands of objects, the ATN network addressing plan is hierarchically structured. This means that it is composed of a set of hierarchical address domains. Each address domain is a set of address formats and values which are administered by a single addressing authority. The ATN SARPs partition the overall ATN NSAP addressing domain (which is itself a sub-domain of the OSI addressing domain) into a number of addressing sub-domains, each with an identified addressing authority, in a recursive fashion. Each addressing authority is responsible for its own address sub-domain, and may further partition it into several subordinate sub-domains, and delegate authority for these sub-domains. This principle allows the establishment of sub-address spaces (i.e. the set of values within an addressing sub-domain) in a hierarchical fashion without the need to co-ordinate between sub-address spaces. This principle of hierachically structured ATN sub-domains within the global OSI addressing domain is illustrated in Figure 1 for the example of the ATN NSAP addressing domain.

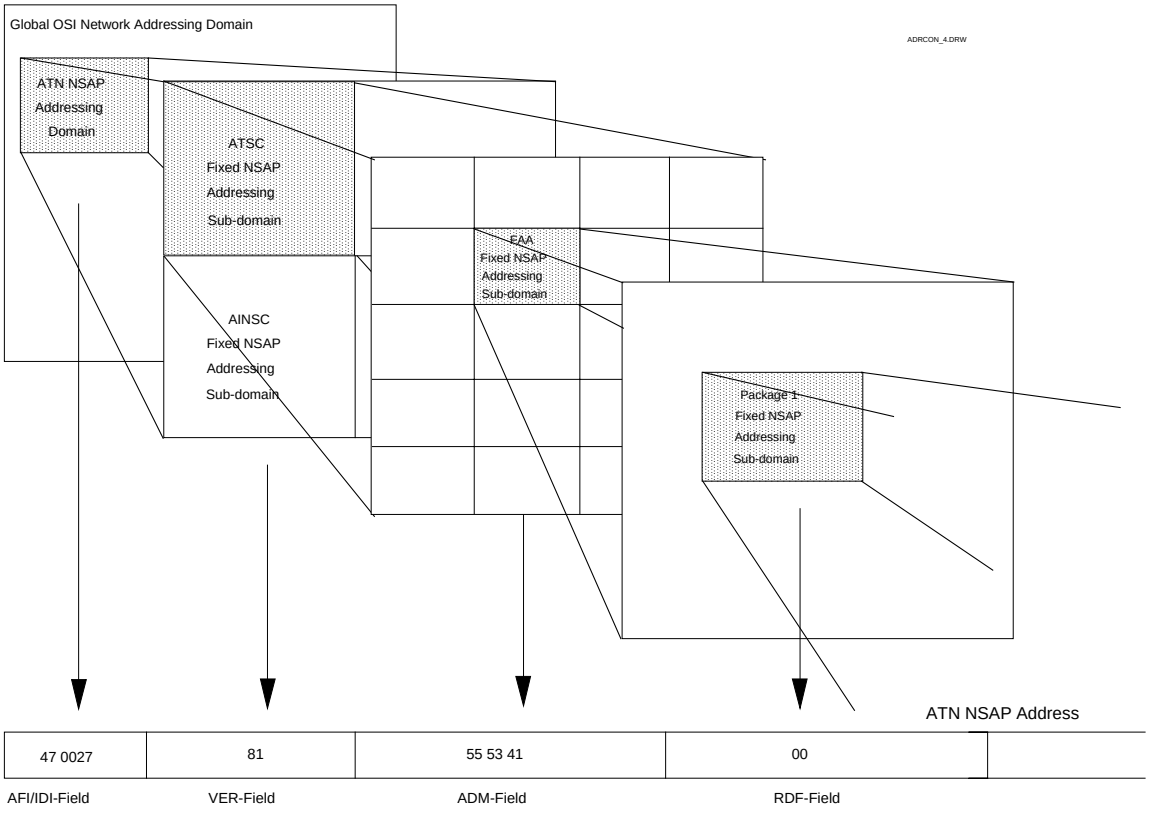


Figure 1: Hierarchical Decomposition of Addressing Domains Illustrated for ATN Network Addresses

Figure 1 shows how the global OSI network addressing domain (which is itself a sub-domain of the global OSI addressing domain) is partitioned into several sub-domains, one of which is the ATN NSAP address sub-domain. This sub-domain is itself decomposed into a number of subordinate addressing sub-domains in a recursive fashion. Each such sub-domain is associated with an NSAP addressing authority which is responsible for this sub-domain, and may further delegate authority for those sub-domains into which it has partioned its own addressing subdomain. This principle allows to construct ATN addresses as a sequence of individual address fields (see Figure 1), with each field corresponding to an addressing sub-domain. As these sub-domains are individually administered, the address field formats and values can be assigned without the need to co-ordinate between addressing authorities.

3. Naming and Addressing Authorities

A naming/addressing authoritiy defines the rules, including syntax (i.e. sizes and formats) and semantics (i.e. contents and interpretation), for specifying names/addresses within its naming/addressing domain and for the creation of further sub-domains. Furthermore, it allocates names/addresses within its domain according to specified rules, but does not perform the binding of the allocated names/addresses to the associated objects. This latter task is within the responsibility of the registration authority (see section 4.2.1).

A naming/addressing authority may administer and allocate names/addresses itself, or, if it has partioned its naming/addressing domain into naming/addressing sub-domains, may delegate the responsibility for naming/addressing within each such sub-domain to a sub-domain naming/addressing authority.

The overall naming/addressing authority for the ATN naming/addressing domains is ICAO which controls and manages these domains through the ATN SARPs.

Besides partioning the ATN naming/addressing domains into appropriate sub-domains and specifying the syntax, semantics and encoding for these sub-domains, the ATN SARPs also directly allocate and register names/addresses within these sudomains, where appropriate or required. Furthermore, provisions have been made within the ATN SARPs which delegate full or partial responsibility for certain sub-domains (i.e. certain address fields) to organisations other than ICAO, such as IATA, regional ATS organisations and national ATS administrations. In order to comply with the ATN SARPs, these organisations have to implement the procedures for a naming/addressing authority and, where required, for a registration authority.

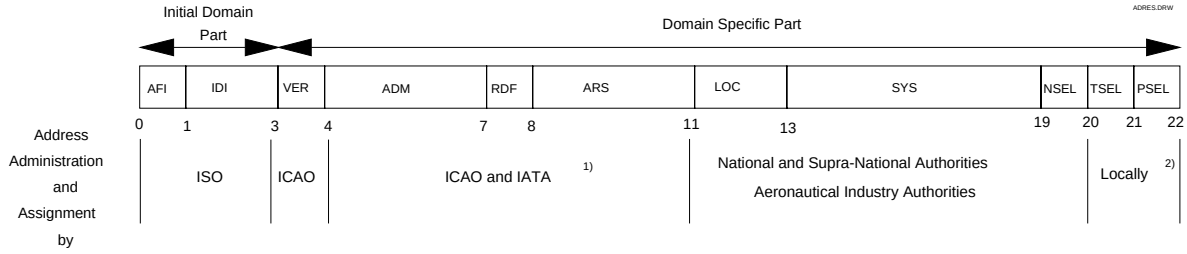
4. Name and Address Allocation

4.1 Address Allocation Principles

The general philosophy that is underlying the assignment of ATN network addresses is that the administration of the higher order address parts (i.e. the address domains which are close to the root of the hierarchical address structure) is performed by entities with a global scope, e.g. international organizations, such as ISO, ICAO and IATA. The further down in the hierarchical address structure one moves (i.e. the closer to tail of the address), the more the responsibility for address assignment and administration is delegated to entities with a more restricted scope, such as regional, national or local authorities. This means that the initial part of each ATN NSAP address and NET (i.e. the address prefix) is administered on an international level, the tail of the address is administered locally. Furthermore, this means that the process of allocating an address to an ATN object involves several authorities at different levels.

Figure 2 illustrates this distributed responsibility for address allocation using the example of an ATN TSAP address. This type of address is composed of 10 consecutive address fields comprising a total length of 21 or 22 bytes. According to the ATN addressing plan, address values within the first two fields (AFI and IDI) are assigned by ISO, within the next field (VER) by ICAO, within the fields four to six (ADM, RDF, ARS) by ICAO and IATA and within

the fields seven to nine (LOC, SYS, NSEL) by State authorities and aeronautical organizations. Administration and address value assignment for the last field (TSEL) will be done locally.



1) Authority may be further delegated to State authorities or aeronautical industry authorities.

2) Allocation, assignment and administration activities may be transferred in parts or completely to the national State authority or aeronautical industry authority.

Figure 2: Responsible Addressing Authorities Illustrated for the Example of an ATN TSAP Address

It should be noted that, due to this hierarchical structure, each addressing authority manages an own addressing space. This addressing space is composed of those address values which establish the complete set of values to be constructed within the fields for which this authority is responsible. The registration authority for this address space is responsible to allocate and register addresses within this address space. The address space of this authority is linked into the overall ATN addressing space by appending the allocated values to the address prefix allocated by the superior address authority (i.e. the previous address fields).

The address registration function for the higher order fields of ATN addresses has already been partially performed in parallel to the development of the ATN SARPs. As a result of this, the values of the address prefix up to and including the RDF field (i.e. bytes 1 through 9 in Figure 2) of ATN addresses for ATSC systems are registered with ISO and ICAO and use either existing, already established international registers or are published in Subvolume 5 of the ATN SARPs. In this sense, the ATN SARPs constitute in itself an international address register.

4.2 Responsibilities of Administrations

As illustrated in Figure 2, a number of address fields of ATN addresses are expected to be registered and administered on a State level or by aeronautical industry authorities. Furthermore, provision are made in the ATN SARPs which foresee the delegation of the administrative responsibility for address assignment by ICAO to State authorities or aeronautical organizations.

Thus States are expected to assume full responsibility and administrative duties related to their own and/or delegated address space(s). The practical effect of this is that States, doing so, must establish the necessary administrative structure to carry out allocation, assignment and administration activities for ATN addresses, i.e. to place into operation an address (and naming) registration authority.

4.2.1 Registration Authority

A registration authority may be an organisation, a document, an automated facility, or any other body capable of name/address assignment that performs registration of one or more types of objects within its jurisdiction. The set of name/address values administered by a single registration authority consitutes the naming/addressing domain of this authority.

A registration authority is a specific instance of a naming/addressing authority (see section 3).

The role of a name/address registration authority is to :

- ❒ assign and make available unambiguous names and addresses,
- ❒ record definitions of the instances to which those names and addresses are assigned, and
- ❒ propagate registered names and addresses to interested parties.

This includes activities such as:

- receiving proposals for register entries from applicants[1]
- processing received proposals for register entries, i.e. effect any necessary rationalization or co-ordination of these proposals, such as check of responsibility of registration authority, verification of the qualification of the applicant, verification of the compliance of the proposal with the relevant provisions in the ATN SARPs
- recording names/addresses for each register entry that is accepted in accordance with the specified procedures for a register entry
- conveying the results of the registration, i.e. the decision taken on the proposal, to the appropriate applicant, and
- promulgating the register entries within its sphere of responsibility according to specified procedures and in a specified form.

A user of a registration authority may request an allocation of names/addresses from a registration authority, leaving the choice of names to the registration authority. Alternatively, a user of a registration authority may request an allocation of particular names/addresses. The registration authority may grant that request if it chooses, provided the names/addresses have not previously been issued.

The use of a name/address can be terminated by a registration authority and then the name/address re-used at a later time. The precise rules and constraints related to the re-use of a name/address to ensure unambiguity are within the responsibility of the registration authority.

Assigned and registered addresses have to be promulgated in order to enable communication partners to set up communication with the respective ATN system. The form how this address information is conveyed may reach from bilateral exchange of address registers on an "as-needed" basis to regular publication of official directories to a broad community, based on the individual security and reachability requirements of each participant in the ATN. (This promulgation of address information, which is a pure administrative matter and will most likely result in appropriate static configuration of ATN systems, should not be confused with the dynamic distribution of address information by routing protocols during ATN operation).

4.2.2 Delegation of Responsibilities

A State or organization may chose to delegate its responsibility for its own addressing space to another State or organization if it does not wish or if it is not practical to establish an own addressing authority and to carry out own administrative registration activities. In the case of delegation of addressing authority the respective State(s) or organization(s) have to assume full administrative duties related to the delegated responsibilities. Appropriate interstate arrangements have to be established on a mutually agreed basis which cater for this transfer of authority.

4.3 Responsibilities of ICAO

Beside acting as addressing authority for a given portion of ATN addresses, the role of ICAO in the area of naming and addressing is one of international co-ordination, advice and

[1] An applicant may be an ATS authority, a supra-national ATS organization, an airline, an aircraft operator, an aeronautical communication service provider or any other aeronautical industry organization.

consultation. Thus, ICAO may be expected to provide counsel to States and organizations having assumed such delegated responsibilities, in order to ensure that address administration is carried out in a manner that supports the orderly and efficient operation of the global ATN.

5. ATN Address Administration and Registration

In order to ensure unambiguous assignments, names and addresses must be registered by registration authorities within the context or environment in which they are to be used.

Name/address registration is the mechanism through which a name/address is assigned to an object in a way which makes the assignment available to interested parties. It is carried out by a naming/addressing registration authority (called registration authority in the following).

5.1 Subnetwork Address Administration and Registration

Registration of SNPAs is generally a consideration local to a subnetwork, but the SNPA addresses assigned to specific systems or services should be made available to all interested parties attached to a given subnetwork.

5.2 Network Address Administration and Registration

ICAO is the administrative authority of the ATN internetwork addressing plan and administers this plan through Subvolume 5 of the ATN SARPs. Subvolume 5 defines and administers the ATN NSAP address syntax (i.e. field boundaries, field sizes and field formats), the ATN NSAP address semantics (i.e. the field content and interpretation), and the ATN NSAP address encoding procedures (i.e. the representation of the abstract field syntax and semantics). Subvolume 5 delegates authority for the definition of the semantic content and the encoding of particular fields as well as the assignment of address values for these fields to other State, aeronautical or telecommunication standards authorities.

Four of the nine address fields of an ATN NSAP address have been assigned fixed values by Subvolume 5 and, consequently, do not need further registration. The values of the remaining five fields should be registered as follows:

ADM-Field

The ADM field shall be assigned a value representing either the IATA or ICAO organisation (depending on the value of the VER field) which is responsible for the identified ATN Network Addressing Domain.

In the case that it is an ATSC addressing sub-domain, the ADM field value will be derived from the ISO country designator set defined in ISO 3166 according to the encoding procedures for this field defined in Subvolume 5. The registration process for the ADM field thus is limited to the establishment of a repository listing all valid ADS field values.

In the case that it is an AINSC address, the ADM field value should be an IATA 3-letter code for airlines (e.g. the ”airline designator”) and other stakeholders. IATA has already set up a registration procedure based on the use of current alphanumeric ”airline designators” with extensions for ”other stakeholders” compatible with the IATA Passenger Services.

One (or more) registration document(s) should be established and maintained, where values for the ADM field of the ATN NSAP address will be registered and published. This could be similar to the ISO 6523 standard document, where International Code Designators (ICD) are listed for addressing authorities registered with ISO (e.g. the value "0027" for ICAO can be found there). The registration document for ADM values may for instance contain tables with the following layout:

ICAO member / ATSC Administration	*ISO Country Code (3 letter code)*	*ADM value (hexadecimal)*
...		

Finland	FIN	46 49 4E
France	FRA	46 52 41
Germany	DEU	44 45 55
...		

IATA member / AISC Administration	*IATA Airline Code (3 letter code)*	*ADM value (hexadecimal)*
...		
Air France	AFR	41 46 52
British Airways	BAE	42 41 45
Lufthansa	DLH	44 4C 48
South African Airlines	SAL	53 41 4C
United Airlines	UAL	55 41 4C
...		

ARS-Field

ARS values should be assigned, administered and registered by the authority designated in the ADM field. A guideline for registration procedures and an outline for a registration document may be established by ICAO and/or IATA as the parent registration authorities.

Note - During the initial stage of Package-1, i.e. until appropriate registration authorities have been established by States, registration of ARS field values under the address space of ICAO will be within the responsibility of ATNP WG2..

Note - A common ICAO/IATA database comprising all registered NSAP address prefixes including the ARS value may be maintained and published through the appropriate ICAO and IATA channels. This database would allow to identify all registered ATN routing domains and the organisations responsible for each one. This database may be the basis of generalised directory services for post-Package 1 ATN deployments.

LOC-, SYS-, N-SEL-Fields

Values for the LOC, SYS and N-SEL fields will be administered and registered by the authority designated in the ADM field.

5.3 Transport Address Administration and Registration

According to Subvolume 5, the TSAP selector of an ATN Transport address is administered on a local basis. This means that TSAP selector values are assigned by the organisation responsible for a given ATN End System within the constraints defined in Subvolume 5.

The value for the TSAP selector field will be registered locally by a State's authority, or airline's or other aeronautical stakeholder's registration authority. In general, there is little need for ATN-wide coordination and publication of registered TSAP addresses. However, in order to support ATN directory services in the long term, the registered TSAP addresses of ATSC applications should be recorded and maintained in a possibly distributed ATN directory under the auspices of ICAO.

Note - The recording and global publication of the TSAP addresses associated with ground CM applications is a requirement for Package-1.

6. Address Allocation and Efficiency of ATN Operation

It is important to understand and to consider the impact of address assignment strategies on the quantity and frequency of exchange of routing information in the ATN, when performing the administrative role of an address authority. Routing information exchange efficiency may be adversely affected without due caution in the process of assigning network addresses.

In order to achieve the expected benefits concerning the reduction of address information in the routing traffic, in particular over severely bandwidth limited air/ground data links, co-ordination of address assignments within a region and/or a State will be required. This means that there may be the need for a centralised form of address allocation within a given region (at least related to air/ground communication objects). This might have the consequence that States have to delegate the responsibility for administration of a subset of their ATN systems to another State or an regional organization.

7. Planning Aspects

It is important to consider that the establishment of an addressing and registration authority has to be planned and prepared well in advance to the operational phase of the concerned ATN systems. First, rules and methods for the registration process have to be defined and established and co-ordination with adjacent States or organizations may be required which have already reached a more advanced stage of their registration process. Secondly, addresses have to be assigned and these assignments have to be communicated even in the early phases of ATN deployment, when there are probably only some few ATN systems. Address "allocation" on a more or less random basis during these initial experimental and test phases should be avoided, as it is cumbersome to cancel existing assignments and re-allocate addresses to objects, if the overall ATN has reached a certain population. This is mainly due to the fact that the impact of such a re-allocation is not limited to the concerned object/system but impacts all its communication partners.