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AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

Working Group Two

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Unresolved Defects from SICASP/5

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SUMMARY

The report of the ATN Manual drafting group was reviewed at Eurocontrol during the SICASP/5 meeting and a number of defects were identified in the ATN Manual approved by the meeting. However, the Eurocontrol comments were received too late to incorporate in the approved text. This paper comprises those comments with reference to the 19/11/93 SICASP/5 approved text. This paper also includes text on a defect in the ATN Routing Topology discussed at the ad hoc ISDG in March 1994, and a proposed resolution.

TABLE OF CONTENTS

1. Defects found in the ATN Manual

1.	A6.1.2.1.1, paragraph 6	The requirement to invoke the Decision Process every time an ISH PDU is received seems to be unnecessary and potentially inefficient if implemented. The underlying requirement is that the decision process is invoked when an ISH PDU is received for the first time over a subnetwork connection and a BIS-BIS connection already exists. Suggest 1st sentence is amended to: When the arrival of the ISH PDU is reported to local Systems Management, if a BIS-BIS connection currently exists with the NET given by the ISH PDU, and it is the first time that an ISH PDU with such an NET has been received over the subnetwork connection from which the ISH PDU was received, then ~~no futher action shall be taken~~ the IDRP Decision Process shall be invoked.
2.	Section 5.9.1, 2nd para	The 2nd and 3rd sentences appear contradictory. At the very least the two sentences should be joined by an "except for". However, it will probably be better to reverse the order to: Both data and routes may be explicitly associated with one of the ATN Security Policies. Data associated with the Security policy identifying Systems Management Communications may pass over any route. All other data may only pass over a route associated with the same security policy.
3.	A6.4.6	The "shall" in the first line is in the wrong place i.e. separated from the "not" by far too much text. Change to: If required by its own Routing Policy, an ATN RD, as part of its routing decision process and with reference to the route's RD_PATH, shall not select a route that has passed through an RD or RDC that is unacceptable to the ATN RD for relaying data associated with the route's security type.
4.	A9.4.2 1st para	The last sentence is possibly over specified, as it could be read that you cannot provide a security parameter with General Communications traffic. A explanatory note would be useful here to avoid mis-interpretation. Also, I am not sure whether the change really captures the proper meaning. Suggest: ATN ES network entities shall provide a security parameter in the Globally Unique Security format~~encoding~~ for all created NPDUs for ~~ATN inter-domain~~ traffic other than General Communications. *Note: General Communications is assumed by default and hence the security parameter can be omitted when the security type of the user data is "General Communications".*

5.	A11.3.1.4, 2nd sentence	This sentence really does not scan right. Also, 8473 does not define a service let alone provide one, and it's not clear what is the subject of the "as defined in" clause. Suggest replace with: Following ISO/IEC 10747, BISPDUs shall be conveyed using the connectionless network service provided by the connectionless network protocol specified in ISO 8473.
6.	Chapter 8, Table 8-1, Security Parameter	Table 8-1 does not appear to be in line with the proposed SARPs in A8.2.2.2. A8.2.2.2 appears to mandate the provision of the security parameter in the service interface, while table 8-1 makes it optional. The only case where it need not be provided is when the system only supports General Communications TS-users. Inserting the "=" in the table simply requires that the value of the parameter is unchanged when it is present. Suggest that Table 8-1 is changed to make the parameter mandatory, but with additional guidance to point out the exceptional condition.
7.	A9.1	There are two problems with this recommendation. The first is that it is not linked to the way congestion information is reported. The second is that routers can also be congested in addition to subnetworks. Indeed, the former form of congestion is arguably the more significant. Suggest replace with: **Recommendation:** *Mechanisms should be provided to signal the onset of network congestion to the transport entity, under at least the following situations:* *1. when an NPDU arrives with the Congestion Experienced bit set.* *2. When an Error Report is received indicating that an NPDU has been discarded due to congestion* *3. When systems management reports congestion on a path followed by NPDUs generated by the transport entity.* *In each case, the congestion notification should be associated with a specific destination NSAP Address, or a group of affected NSAP Address.*

8.	A11.1.2.2.1, 2nd para	This provision was changed from recommendation to SARP by SICASP/5. The result appears to be over specification, and a technically incorrect statement. For example, ISO 9542 is operated between a pair of ISs in support of ISO/IEC 10589. Configuration Information is certainly exchanged, but Route Redirection Information is not. So how is the requirement that it shall both be supported and *used* to be met. A similar situation occurs when two BISs interconnect over a LAN, when 9542 may be used to bootstrap the connection process in the same manner as for mobile communications. The original recommendation was arguably technically incomplete. However, as a recommendation it could be ignored in circumstances to which it was inappropriate. Changing it to a requirement simply exposes the deficiencies of the original statement and creates a technically incorrect requirement. Best to return it as it to a recommendation.
9.	A11.1.2.2.2	As above, the change to requirement from recommendation results in over specification. For example, prohibiting the use of Configuration Information is not appropriate to multicast general topology subnetworks (e.g. X.6).
10.	A11.1.2.2.2, 3rd para	The requirement that Route Redirection information be used over point-to-point links is in conflict with 9542 itself (see clause 5.4.1.2). Delete the reference to "Route Redirection Information". While 9542 may not be entirely correct, there is no need for the ATN Manual to make any specific statement on this issue, and there is certainly no good need to mandate its use.
11.	A10.6.4.3.2, page 11	The paragraph beginning "It is important to specify the order.." is inappropriate for SARPs. The 2nd sentence reads like guidance. The 3rd and 4th sentences contain "should", but this is not a recommendation. "Shall" does not appear anyway in the text.
12.	A10.6.4.3.2, item 7	The phrase "shall only contain an PDU as defined in ISO 9577 SPI" does not make sense. Suggest replace with: <u>shall only contain a recognisable NPDU starting with an SPI listed in ISO 9577</u>
13.	A10.6.4.3.2, Page 12, paragraph preceding Note 8	The phrase "shall only contain a PDU as defined in ISO 9577 SPI" does not make sense. Suggest above fix here.
14.	A8.2.2.2 bullet 2	use of "proposed" is incorrect, as the security type is non-negotiable. Worse, it may be mis-read as implying use of the (negotiable) COTP protection QoS. Delete "proposed"

15.	A8.2.4.1.4.1.3, Item T4F30	PDUs from transport connections with different security types should not be concatenated. T4F30 needs expanding, and should have the phase "or with different security type" appended to the end of the requirement.

2. ATN Mobile Routing Problem

2.1 Problem Statement

Section A6.3.4.2 rule 3 of the ATN Manual provisions on routing policy states that an ATN RD shall advertise to other ATN RDs on the same ATN Island:

> 3. The selected route to every Mobile RD for which a route is available and in which the receiving RD has previously indicated an interest. The DIST_LIST_INCL attribute shall be present and shall contain no more than the RDI of the adjacent RD, the RDI of the local ATN Island's Backbone RDC, and the RDI of any RDs which provide a route between the adjacent RD and the ATN Island's Backbone.

Backbone RDs are also required by A6.3.2.4 to advertise routes to Mobiles, to the "Home" Domain, and by A6.3.2.2 to advertise such routes to other RDs on the Island, when required.

The problem comes from the fact that the ISO definition of DIST_LIST_INCL is restrictive in that when a DIST_LIST_INCL attribute is present in the route's path, the Backbone RD is not permitted to re-advertise the route to another RD unless its RDI is listed by the DIST_LIST_INCL. As A6.3.4.2 does not specify that the "Home" RD's RDI is included in the list (and indeed the RDI cannot be predicted in advance), the Backbone RD is not permitted by the ISO standard to carry out the requirements of A6.3.2.4. Similarly, it cannot carry out the requirements of A6.3.2.2.

2.2 Discussion

When the provisions of the ATN Manual were written, it was assumed that local policy took precedence over DIST_LIST_INCL, and it is believed that this is still a correct view. However, the provisions of the ISO standard take a more restrictive view and effectively impose one RD's policy on another. One way to resolve this problem is to report this as a defect to ISO. However, review of the use of DIST_LIST_INCL approach suggests that a different approach may be appropriate for the ATN SARPs.

The origin of the ATN Island concept was the view that the ATN would be established first as separate regional networks which would only later come together to form a single worldwide ATN. These separate regional networks were called ATN Islands.

Within each ATN Island the main technical problem was seen to be convergence on a stable set of routes to mobile systems (i.e. aircraft), and provisions were added to enforce a "root and branch" structure to the Island with a set of "Backbone" RDs at the top of this hierarchy and at the core of the Island. Routes to Mobiles would always be advertised first to the Backbone and then distributed from there. This model of operation was seen as providing a simple structure for avoiding the routing loops that cause dynamic instability.

The mechanism used to enforce the rule that routes are first advertised to the Backbone is the DIST_LIST_INCL attribute.

A similar instability problem was also foreseen when the ATN Islands were interconnected to form the worldwide ATN. However, it was not believed possible or appropriate to mandate a worldwide Backbone. Instead, the idea of a “Home” Domain was evolved.

Under this strategy, aircraft for which inter-Island communications are required to have a “Home” domain, which is a Routing Domain in an ATN Island’s backbone. This “home” need not be in either the ATN Island through which the aircraft is currently reachable, or in the ATN Island with which communication is required. The rôle of the “Home” domain is to advertise a default route to all the aircraft belonging to an airline, or the General Aviation aircraft of a given country of registration. This default route is advertised to all other ATN Island’s backbone routers.

The backbone routers of an ATN Island then have a simple policy rule to implement for each explicit route to an aircraft that they have available. If a default route to the aircraft’s Home exists[1] then the route to the aircraft is advertised to the Routing Domain advertising that default route. Otherwise, the explicit route is not advertised outside of the Island.

The impact of this rule is that the “Home” is always kept aware of routes to all of “its” aircraft. As it is also providing the default route to such aircraft, routers on other ATN Islands that have packets to route to one of that “Home’s” aircraft will by default send those packets to the “Home” Routing Domain, where the actual route to the aircraft is known, and thus the packet can be successfully routed to the destination aircraft.

2.3 Defect Resolution

What was never down during the development of the ATN Routing Concept was to take the routing to the “Home” approach back to the ATN Island and to see if a common approach to managing the instability problem could be developed. In fact, it is possible to establish a common approach, and the result not only resolves the conflict with the ISO standard, but also considerably simplifies the ATN Island.

The Backbone RDs effectively provide a default routing service for routing to all mobiles, in the same way that the “Home” Domain provides a default routing service for routing to the Mobiles of a given airline or country. This can be formalised by the Backbone RDs implementing a simple policy rule which states that they always generate and distribute within an ATN Island, a route to *all aircraft*. This requires a minor update to the addressing plan, but is otherwise readily achievable.

Such a default route would replace the existing requirements for a Backbone RD to advertise to the rest of the Island, routes to every “Home” Domain, and, when required, routes to every mobile currently adjacent to the Island.

This results in a considerable reduction in the number of routes being advertised and in the complexity of the decision process in a Backbone router.

The existence of such a default route also enables the specification of a simple policy rule for enforcing initial distribution of a route to a mobile to the Backbone only (and thereby enabling the Backbone to provide the default routing service). This rule is a simple variation on the one already used for propagation of routes to the “Home” Domain, and will simply require that within an ATN Island, a route to a mobile is always advertised to the RD currently advertising the preferred route to *all aircraft.*

[1] Such a route is readily identifiable from the destination address prefix, as all address prefixes that characterise an aircraft belonging to the same airline descend from a unique address prefix.

The above is not the only policy rule that can apply to routes to aircraft. Routes to aircraft could also be advertised to any other Routing Domain within the Island, provided that a policy rule is set up to allow this. This may be because there is a known communication requirement which makes bypassing the backbone desirable, or because it is desirable to provide a second (hot standby) route to aircraft from the backbone.

This is a much more flexible approach than with DIST_LIST_INCL and makes the ATN Island much more robust to communications failures. This is because the use of DIST_LIST_INCL required static configuration information which might be invalidated by communications failures, while the proposed replacement rule uses dynamic routing information and is hence responsive to failures.

The proposed resolution therefore reduces the overhead of routing to mobiles within an ATN Island, reduces the complexity of the Backbone Router, and is more robust to failures.

2.4 Recommendation for Future SARPs and Guidance Material

The Workng Group is recommended to consider the following proposed revisions to the ATN Manual Provisions when developing future ATN SARPs.

2.5 Ref: A7.5.3.3

Replace the first two paragraphs with:

The VER field value for Version 1 ~~of the~~ AISC ATN NSAP Addresses in fixed systems, expressed as a two-digit hexadecimal number, shall be **[01]**.

The VER field value for Version 1 AISC ATN NSAP Addresses in mobile systems, expressed as a two-digit hexadecimal number, shall be [**41**].

The VER field value for Version 1 ~~of the~~ ATSC ATN NSAP Addresses in fixed systems, expressed as a two-digit hexadecimal number, shall be **[81]**.

The VER field value for Version 1 ATSC ATN NSAP Addresses in mobile systems, expressed as a two-digit hexadecimal number, shall be **[C1]**.

2.6 Ref: A6.3.2.2

Delete Items 3 and 4 and replace with new Item 3:

3 A route to all AISC mobiles and all ATSC Mobiles. The well known discretionary attribute DIST_LIST_INCL shall be present, and shall contain the RDI of the ATN Island RDC as its value.

Note. - The objective of this item is to tell the rest of the Island that the Backbone RD provides a default route to all aircraft.

2.7 Ref: A6.3.4.2

Delete Items 3 and 4 and replace with new Item 3:

3. If the RD is currently advertising the preferred route to all AISC and ATSC Mobiles, then every route to an AISC Mobile and an ATSC Mobile that is known to the local RD shall be advertised to this RD, subject only to constraints imposed DIST_LIST_INCL and DIST_LIST_EXCL.

Note.- The objective of this item is to ensure that the provider of the default route to all aircraft (i.e. the Backbone) is kept informed of the actual location of every aircraft adjacent to the Island.