EUROCONTROL

ATNP/WG2/
WP/266
22 April 1996

AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

WORKING GROUP TWO

Brussels 22.4.96-27.4.96

The Use of ATSC Class in the ATN Internet

Presented By Henk Hof

Prepared by Tony Whyman

SUMMARY

This paper has been produced in order to agree a definitive understanding of the User Requirement for ATSC Class, its implications for the final SARPs text, and how ATSC Class may be used in practice. The contents of this paper also provide the substantive contents of the Defect Report and Change Proposal necessary to bring the SARPs in line with the User Requirement, and draft Guidance Material on the use of ATSC Class.

DOCUMENT CONTROL LOG

SECTION	DATE	REV. NO.	REASON FOR CHANGE OR REFERENCE TO CHANGE
	22-Apr-96	Issue 1.0	

TABLE OF CONTENTS

1. Introduction

1.1 Background

The ATSC Class concept was introduced in the Washington WG2 meeting **[1]**. A primary objective of this meeting was to develop SARPs for handling the strong Quality of Service (QoS) requirements introduced by IATA representations and, in particular, to consider a proposal developed by technical experts and contained in **[2]**. In a joint meeting with WG3, these proposals were considered and similar strong QoS requirements were developed for ATSC Applications. These introduced the notion of ATSC Class and are described in Appendix G of **[1]**.

SARPs text was then developed subsequent to the meeting, in line with the requirements agreed at the meeting and following the approach outlined in **[2]**. These were, in turn, agreed at the Rome WG2 meeting. Since then, validation work has progressed and discovered anomalies in the SARPs requirements; the anomalies appear to be due to mis-understandings as to what the user requirements for ATSC Class are.

1.2 Scope

This paper has been produced in order to agree a definitive understanding of the User Requirement for ATSC Class, its implications for the final SARPs text, and how ATSC Class may be used in practice. The contents of this paper also provide the substantive contents of the Defect Report and Change Proposal necessary to bring the SARPs in line with the User Requirement, and draft Guidance Material on the use of ATSC Class.

Chapter 2 is for WG3 review and approval. It contains analysis of the User Requirement and a proposed interpretation of the requirement. Chapter 3 is for WG2 review and approval. It contains analysis of the implementation of the features necessary to meet the User Requirement and a draft Change Proposal for the modifications necessary to meet the interpretation given in chapter 2.

1.3 References

1.	ATNP/WG2/4/Report	ATN Internet Working Group 2 (WG2) - Fourth Meeting Report
2.	ATNP/WG2/WP117	Meeting Application Specific Routing Policy Requirements in CNS/ATM-1 Package
3.		CNS/ATM-1 Package SARPs and Guidance Material - Sub-Volume 5 Internet Communications Service

2. The User Requirement

2.1 As Stated in Washington

The following is the text agreed at the joint WG2/WG3 meeting that provided the User Requirement for the specification of ATSC Class.

Note: ATSC messages must only be routed using routes authorized to carry ATSC message traffic.

ATSC routing policy shall be applied on a "strong" basis.

Note: "Strong" ATSC routing policy means that routing decisions will be based upon the advertised capability of the route. If the route advertises the capability to provide the stated service, the route will be considered for use. "Strong" ATSC policy does not mean that a particular message will be "killed" if a particular route which advertises a particular capability does not actually provide that capability for a given message.

ATSC applications shall be able to specify that message traffic for a given association be routed according to a class of service based upon the following requirements:

Note: Transit delay values will be provided for each class of service at the next Working Group 3 meeting.

1. Class A, max. expected transit delay of TBD.

2. Class B, max. expected transit delay of TBD (value will be greater than for Class A).

3. Class C, max. expected transit delay of TBD (value will be greater than for Class B).

4. Class D, max. expected transit delay of TBD (value will be greater than for Class C).

5. Class E, max. expected transit delay of TBD (value will be greater than for Class D).

6. Class F, max. expected transit delay of TBD (value will be greater than for Class E).

7. Class G, max. expected transit delay of TBD (value will be greater than for Class F).

8. Class H, no max. expected transit delay.

For a given class of service, route selection shall be based upon the routes capability to meet or exceed the required level of service (e.g., if Class D is selected by the application, routes which provide Class A, B, C, or D service may be used). If multiple routes are available which meet or exceed the selected service, the route with the lowest relative cost shall be selected.

Note: For the CNS/ATM-1 Package, it is expected that subnetworks will be allocated a service class and a relative cost on a local basis for local routing policy decisions. It is expected that the delay allocation will only be enforced on the air/ground path selection for the CNS/ATM-1 package.

Note: Routes which advertise the capability to meet a designated service class are expected to deliver messages with an actual transit delay performance whereby 99% of messages are delivered in less than the route allocation of the max. expected delay for that service class.

2.2 As Refined in Banff

At the Banff WG2 meeting, WG3 presented its requirements for the maximum expected transit delay. The main substantive change added here was to change the semantics of class H to reserved rather than no maximum transit delay.

2.3 And According to Recent Discussions

The use of ATSC Class was reviewed at the WG2 Configuration Control Board (CCB) in Washington (26-28/3/96) while considering Defect Reports on the detailed interpretation of ATSC Class. Concerns were raised that the current interpretation of the User Requirement led to limitations in its use, and the User Requirement was therefore queried. This led to the following response from the rapporteur of WG3:

The discussions, going back to Toulouse and Fair Oaks, on the use of ATSC traffic types (not exactly QoS) were:

- *The router would invoke a strong policy for the fact that the packet is ATSC traffic (i.e., packet would be routed only over subnetworks authorized to carry ATSC); however*
- *The policy would be weak in attempting to satisfy the specified end-to-end delay associated with the specified ATSC traffic type (i.e., best effort to satisfy the desired max. end-to-end delay).*

Since the CAA's will need to certify each subnetwork that will carry ATSC, it is essential that a strong routing policy be used to control which subnetworks will be used for ATSC traffic.

Thus, the routing policy has both a strong and weak aspect. Perhaps this has led to the confusion.

2.4 Discussion

The User Requirement was queried as a result of a discussion at the recent WG2 CCB meeting, where, it had become clear when reviewing a related defect, that the uncompromising strong QoS interpretation of the User Requirement had led to expensive implementation decisions in the Internetwork. As a result of the subsequent discussions, it is now believed that WG3 had not intended quite such a strict interpretation of their requirements to have been made.

The problems that were discussed by the CCB, are the result of a strong QoS interpretation. The downside of a strong QoS requirement is that

1. Potentially available routes are ignored simply because they are not believed to offer the required QoS. This translates into a cost for the network operator i.e. routes with the required QoS must always be made available, at the availability level required by the user.

2. Strong QoS limits the degree to which routing information distribution can be optimised. Such optimisation always results in a degree of information hiding. However, in a strong QoS environment, detailed information about the believed available QoS always has to be provided, otherwise, as either:

   a) if information hiding results in the lowest possible QoS being advertised, then users implementing strong QoS policies will cease communicating rather than take the risk that their data will not get the required QoS, or

   b) if information hiding results in the highest possible QoS being advertised, then data may be sent only to be discarded when it is found that the required QoS was, in reality, not available.

In this context a relaxation in the User Requirement, however this came about, has to be welcomed, as it offers a chance to reduce ATN deployment costs and improve the optimisation of routing information distribution.

2.5 The Proposed Interpretation of the User Requirement

Following discussions between WG2 and WG3 experts, the following interpretation of the User Requirement for ATSC Class is proposed:

1. It shall be possible to identify transport connections and TSDUs that carry ATSC related data.

2. For ATSC related data, it shall be possible to identify the required Quality of Service to be provided either to data transferred over a given transport connection or by an individual (connectionless) TSDU. For this purpose a hierarchical set of classes shall be defined, where each class specifies the mean transit delay that shall be achieved, and the 95th and 99th percentiles. Implicitly, this also defines the availability target.

3. It shall be possible to identify the ATSC Class supported by each route through the ATN Internet that has been certified to support ATSC related data.

4. ATSC related data shall only be routed over ATN Internet routes that have been certified to carry ATSC related data. ATSC related data shall be discarded rather than routed over non-certified routes.

5. ATSC related data shall, wherever possible, be routed over a route through the ATN Internet that supports the ATSC Class associated with the data. If such a route is not available then

   a) the route with the lowest available ATSC Class is chosen that is greater than the ATSC Class required by the sender of the NPDU, or

   b) if no such route is available then, the route with the highest available ATSC Class is chosen.

It should be noted that the key change is the addition of 5(b). This permits a “first strong then weak” approach.

3. ATSC Class and the ATN Internet SARPs

3.1 The Current Situation

3.1.1 Associating User Data with an ATSC Class

Although the user requirement is necessarily phrased in terms of the transport service, the ATN Internet routing function works at the network level. Data sent over transport connections and as individual TSDUs, is formatted as TPDUs and then passed to the network layer, which adds its own header to each TPDU. This then becomes an NPDU to be routed through the ATN Internet. So that ATSC identification information (i.e. the Traffic Type) and the required ATSC Class is visible to the routing function, the ATN specification requires this to be encoded as part of the NPDU header and, specifically, as part of the Network Layer Security Label; this provides a convenient field in which to encode information related to a user required routing policy.

The Traffic Type and, where applicable, the required ATSC Class associated with each packet of user data, is therefore encoded in an NPDU’s Security Label.

This meets requirements 1 and 2 in 2.5, above. The traffic type associated with each transport connection is identified by the security label in the NPDU that conveys the initial CR TPDU and repeated in every NPDU carrying the subsequent transport connection’s TPDUs. Similarly, the traffic type associated with each connectionless TSDU is identified by the security label in the NPDU(s) that convey the TPDU(s) derived from that TSDU. The required ATSC Class is also conveyed in the same security label.

3.1.2 Encoding the ATSC Class Supported by a Route

Similarly, the ATSC Class, if any, supported by each route through the ATN Internet is encoded in the Security Path Attribute for routes advertised by the Inter Domain Routing

Protocol (IDRP). Each route advertised within the ATN Internet can therefore be readily associated with the ATSC Class that it supports.

As a result of a recently agreed Change Proposal, ATSC Class support is now encoded as a bitmap, allowing all supported classes to be properly identified, at least when routes to identical destinations were merged. This was to avoid a masking effect with Route Merging, whereby higher ATSC Class routes effectively become invisible after routes were merged. However, the masking effect will still be apparent when routes to dissimilar destinations are aggregated. This is because, in such cases, the advertised ATSC Classes must be applicable to all destinations. Even with a bitmap encoding the aggregation rule for the ATSC Class information, when routes with different NLRI are aggregated, has to result in an encoded value indicating support for only the lowest ATSC Class supported.

The above meets requirement 3 of 2.5. The ATSC Class supported by each route is identified by information conveyed in its security path attribute. This information is preserved following aggregation, albeit with some information loss when routes to different destinations are aggregated.

3.1.3 Forwarding Rules

The last part of the ATN SARPs supporting the use of ATSC Class is concerned with the specification of the forwarding rules i.e. over which routes are NPDUs of a given ATSC Class actually routed. These rules are contained in section 3.2.1.2.1.2 of the ATN Internet SARPs and simply require that an NPDU indicating a required ATSC Class is forwarded over a route supporting the same or a higher class. Otherwise, it is discarded.

This meets requirement 4 of 2.5, as forwarding is only permitted over routes identifying an ATSC Class. However, only requirement 5(a) is met. Requirement 5(b) is not. This is because the current draft SARPs require that an NPDU is discarded if a route supporting the same or a higher class is not available.

3.2 What Needs to Change

Clearly, the draft SARPs need to be changed so that requirement 5(b) of 2.5 is also met. This requires a change to the forwarding rules only. The draft SARPs already require that NPDUs are labelled with the ATSC Class required, and similarly, that routes identify the ATSC Class supported. The problem is purely with the forwarding rule, and an extra rule appears necessary in order to meet 5(b). The following revisions to 3.2.1.2.1.2 are proposed in order to satisfy additionally, requirement 5(b).

3.2.1.2.1.2 ATSC Class Specified

Note 1.— This case corresponds to Traffic Type and Associated Routing Policy Security Tag values 000 10000 to 000 10111 inclusive.

3.2.1.2.1.2.a. If the NPDU contains a CLNP Header Security Parameter in the globally unique format, and encodes:

a) security related information according to Chapter 6 under the ATN Security Registration Identifier,

b) a traffic type of ATN Operational Communications - Air Traffic Service Communications, and

c) a requirement to route the NPDU over a route of a specified ATSC Class, then the NPDU shall be forwarded over a selected route to the NPDU's destination that contains a security path attribute comprising the ATN Security Registration Identifier and security information that comprises:

1. An Air/Ground Subnetwork Security Tag that has "ATN Operational Communications - Air Traffic Services Communications" in its set of permissible Traffic Types, and

2. an ATSC Class Security Tag indicating:

   a) the required class, or a higher class, or.

   b) if no such route is available then, the route with the highest ATSC Class available is chosen.

Note 2.— ATSC Class "H" is the lowest and Class "A" is the highest.

3.2.1.2.1.2.b. If no such route can be found then the NPDU shall be discarded.

3.2.1.2.1.2.c. If multiple routes are available which meet or exceed the required ATSC Class, then the route with the lowest relative cost shall be selected.

4. Recommendations

1. Working Group Three are invited to endorse the User Requirements specified in section 2.5 of this document, and to pass this paper to Working Group Two for further consideration.

2. Working Group Two are recommended to generate a Defect Report identifying that the current draft SARPs do not support requirement 5(b) of section 2.5, and to approve the text in section 3.2 as the basis of the Change Proposal to resolve this defect.