

ATNP/WG2/
WP/
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AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

WORKING GROUP TWO

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**Response to WG2/WP444 on Status of ISO Multicast
Networking Standards**

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SUMMARY

ATNP/WG2/WP442 presented proposals for the development of multicast communications standards for the ATN Internet, and ATNP/WG2/WP444 notified the Working Group that ISO had made some progress on the development of standards for multicast communications. Under action 14/7, the author was asked to progress the development of ATN Multicast standards. This Working Paper is the result.

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1. Introduction

1.1 Background

ATNP/WG2/WP442 presented proposals for the development of multicast communications standards for the ATN Internet, and ATNP/WG2/WP444 notified the Working Group that ISO had made some progress on the development of standards for multicast communications. Under action 14/7, the author was asked to progress the development of ATN Multicast standards. This Working Paper is the result.

1.2 Scope

This document itemises the current status of ISO standards and compares them with the contents of WP442.

2. Current ISO Multicast Standards

1. Amendment 1: 1995 to ISO/IEC 8473-1: 1994 provides multicast extensions to CLNP. This text is mostly editorial in nature so that ISO/IEC 8473 recognises that multicast forwarding exists and is distinct from single cast forwarding.
2. ISO/DIS 9542 is in the progress of replacing ISO 9542: 1988 (the ES-IS protocol). This draft international standard incorporates both amendment 1 (NSAP Address Assignment) and Amendment 2 (Multicast Extensions).
3. Amendment 1:1996 to ISO/IEC 8602:1995 (Addition of connectionless-mode multicast capability) extends the use of the connectionless network layer multicast service to the transport layer.
4. ISO/IEC 8348:1996 (Network Service Definition) incorporates Amendment 5 (addition of Group NSAP Address).

3. Comparison with WP442

In formulating WP442, the Group NSAP Address scheme added to ISO/IEC 8348 was known and taken into account, as were the multicast extensions to ISO/IEC 8473.

Amendment 1:1996 to ISO/IEC 8602:1995 was not known at the time that WP442 was drawn up, and it has not yet been possible to obtain a copy. However, it is only two pages long and is assumed to be editorial. There are no protocol extensions needed for the connectionless multicast transport service and WP442 was concerned with transport addressing conventions, which are properly outside of the scope of international standards.

Amendment Two to ISO/IEC 9542 was similarly unknown at the time that WP442 was prepared and has now been obtained (ref: ISO/IEC JTC1/SC6 N9571). It is a more substantive work than the other available ISO documents and needs careful comparison with WP442. WP442 specified its own multicast extension to ISO/IEC 9542.

3.1 Key Differences

While the intended result is the same, there is a significant difference in the way the result is achieved:

1. N9571 uses a conventional (in the 9542 context) broadcast "Hello" multicast out to all multicast capable ISs. It does not expect a specific response from an IS. The ES is not informed about whether it has been possible to join the multicast group.
2. WP442 uses a directed registration sent to a specific IS. This IS is expected to respond in a positive or negative fashion, with no response being negative. The ES knows when it has been possible for it to join the multicast group, and is informed when membership of the group has been lost.
3. N9571 specifies a mechanism by which an IS can inform multicast capable End Systems of the multicast subnetwork addresses on which NPDUs addressed to particular group NSAP Addresses are to be broadcast.
4. WP442 uses the response to the multicast registration to perform a similar function.

3.2 Analysis of Differences

N9571 has been specified as a natural extension to ISO/IEC 9542, while WP442 was specified bearing in mind ATN requirements and this leads to the different styles and advantages and disadvantages of each approach:

- a) ATN User Requirements tend to place great importance on knowing when communication has been lost. With the N9571 approach, loss of membership of a multicast group can only be determined through non-receipt of data. When multicast communications are used for continuous or regularly data transfer (e.g. radar data distribution) this is not an issue. However, when it is used for irregular communications (e.g. DFIS type messages to a group of aircraft), then there is no easy way to detect loss of group membership.
- b) Multi-homed End Systems are expected to be the norm in the ATN. WP442 was deliberately designed to avoid a multi-homed End System receiving multiple copies of the same multicast NPDU, and achieves this through the directed registration mechanism. Furthermore, if registration is not possible through one subnetwork and router, the reporting of loss of membership ensures that the End System can try to gain access to a multicast group through an alternative subnetwork/router.
- c) Under N9571, if an End System sends out its End System Group Hello (ESGH) on multiple subnetworks then it can expect to see multiple copies of each NPDU. Indeed, there is no easy way for the Routers to recognise such a multiple homed ES and suppress multiple copies, because the ESGH does not include a System Level Identification (e.g. an NET), the only possibility is to infer such information from ESH PDUs - however, consistency between the NSAP Addresses reported by ESH PDUs on different subnetworks is not guaranteed.

If N9571 is used unmodified for the ATN, multi-homed ATN End Systems will have to broadcast their ESGH PDUs on all attached subnetworks in order to ensure high availability. However, in turn, they will typically receive multiple copies of the same NPDU sent to the multicast groups that system listens to. The ES will not be told when total loss of service occurs.

This is not very desirable and may not meet user requirements. In this context, it should be noted that N9571 cannot really be regarded as a mature standard that has been widely implemented. It has been constructed to meet a set of perceived user requirements and is part of a currently incomplete set of multicast extensions to the OSI standards.

N9571 appears to meet a requirement for best efforts general multicasting where any End System may send an NPDU to a given Group NSAP Address. However, WP442 specified a more constrained model of multicast communications (only one source End System for a given Group NSAP Address) which met a certain set of ATN user requirements (high

availability without frequent NPDU duplication, user informed of loss of access to a given multicast group, etc.) and which were perceived as implementable. N9571 will probably need to be extended to include features present in WP442 if it is to be used for ATN multicast. As it is desirable to keep as close as possible to ISO standards, such enhancements need to be identified and possibly forwarded to ISO as defect reports.

3.3 Enhancements Needed for N9571 use in the ATN

N9571 enhancements are needed to avoid NPDU duplication with multi-homed End Systems and to report multicast group membership status when the multicast model is restricted to a single source for a given Group NSAP Address. These enhancements appear to be:

1. The ESGH PDU is extended to include an NET that uniquely identifies the source ES. This NET is included in every ESGH PDU sent by the ES and may be used by Routers (and by later extensions to ISO/IEC 10589) to avoid sending multiple copies of the same NPDU to an ES.
2. The concept of the "Active Multicast IS" and the Multicast Address Mapping (MAM) PDU does not appear to be appropriate to this model of multicast communications. Instead, a new PDU needs to be introduced which allows ISs to respond to ESGH PDUs and report the multicast Group Addresses for which they are part of the multicast distribution tree, and the SNPA Addresses to which they will send them. This similar to the Register Acknowledge PDU of WP442.

The really important enhancement is the second one as will extend N9571 to operate in an ATN compatible manner. Once an ES has determined which Routers can satisfy its request to join a multicast group, it can then cease broadcasting its ESGH and send it singlecast to that Router (thus hopefully avoiding duplicates). Should that Router ever stop sending out its PDU announcing that it supports that multicast group, then End System can start broadcasting the ESGB on all subnets in order to locate an alternative.

4. Recommendations

It is recommended that WG2:

1. Considers the above comparison
2. Agrees on the ATN user requirement for multicast communications
3. Determines if the proposed extensions to N9571 are appropriate and should be further developed.