WG2/**WP485**

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Agenda Item 6.4

Mobile Subnetwork Connectivity Reporting Under R.F. Channel Fading Conditions

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Summary

The ICAO ADS Panel developed the operational requirements for the ATS data link applications concurrent with the ATNP WG2 development of the ICS SARPs (i.e., Sub-Volume V or Doc 9705). The ADSP has defined very stringent requirements for service availability and continuity of service that probably cannot be satisfied by early (i.e., Package 1) implementations due in part to lack of optimum reporting of mobile subnetwork connection status. This working paper address the issues associated with one of the 3 scenarios described in WP483. Specifically, this working paper addresses the need to better define mobile subnet connectivity reporting under r.f. channel fading conditions.

References:

1. WG2/WP483, "Availability and Continuity of Service for Mobile ATN Users," January 1999

2. WG2/WP474, "Issues Raised on ICS SARPs," K-P Graff, September 1998

3. ICAO Doc 9705, First Edition, Sub-Volume V, 1998

1. INTRODUCTION

The ICAO ADS Panel developed the operational requirements for the ATS data link applications concurrent with the ATNP WG2 development of the ICS SARPs (i.e., Sub-Volume V or Doc 9705). The ADSP has defined very stringent requirements for service availability and continuity of service that probably cannot be satisfied by early (i.e., Package 1) implementations due in part to lack of optimum reporting of mobile subnetwork connection status. This working paper address the issues associated with one of the 3 scenarios described in WP483. Specifically, this working paper addresses the need to better define mobile subnet connectivity reporting under r.f. channel fading conditions. This issue was raised in WP474 presented to ATNP WG2 at its September 1998 meeting in Bordeaux. It was the conclusion of WG2 that this issue would need to be addressed by the 'Package-2' ICS SARPs.

2. BACKGROUND

The following issue was reported to WG2 in WP474:

> *Recently some scenarios were reported that had been encountered while working on FANS-1. These scenarios may impact the specification on updating the security information by an A/G BIS prior to advertisement to an airborne BIS in the current ICS SARPs.*
>
> *In the encountered scenario an aircraft was flying along the coast of Australia, just on the fringe of VDL coverage, with a Satellite connection. The aircraft was constantly coming in and out VDL coverage. A "media advisory" message was generated by the ground station every time the VDL connection changed. Each message to be sent to the aircraft. These messages built up until a constant subnetwork connection was established. They then where all transmitted.*
>
> *A similar scenario could arise in the ATN. A new update would be generated every time the VDL connection changed. Given the slow satellite connections a list of Updates could build awaiting transmittal, wasting bandwidth.*

WP474 further stated under the 'discussion' section:

> *The requirement to re-send the routes every time the subnetwork connectivity changes is in section 5.3.5.2.10.5 and was added in an attempt to inform the airborne router of any changes to the ATSC Class. Consequently this issue is closely related with the issue raised in PDR 98060006 and should be considered when developing a solution for this PDR.*

WG2, at its September 1998 meeting in Bordeaux, concluded that suitable changes to address this issue would be appropriate for inclusion in the Package-2 ICS SARPs.

WP483 attempts to describe the ICS SARPs issue by way of the following scenario:

> *The aircraft may be in a physical location where temporary fading is occurring on the r.f. channel of the primary mobile subnetwork. Under such conditions the mobile subnet may after some delay clear the connection and/or issue a Leave Event then rapidly re-establish connectivity and issue a Join Event. Under extreme, but not unrealistic conditions where the aircraft is operating near the edge of r.f. coverage, some mobile subnetworks may issue a rapid sequence of Joint Events follow by Leave Events followed by Joint Events, etc. In the event where an alternative path exists via another mobile subnetwork such a situation on the primary mobile subnet could result in substantial additional BIS-BIS traffic being routed over the alternative subnetwork and additional delays on packet delivery . . . . as well as increased loading on the alternative path.*

3. DISCUSSION

Under most situations the overall service provided by the ICS is enhanced by having the mobile subnetwork rapidly report the establishment or loss of connectivity. However the combination of primary mobile subnetwork experiencing fades on the r.f. channel combined with the inherent delays in the subnetwork detecting and reporting the loss (or establishment) of subnet connectivity could result in an relatively unstable overall internet service even though a stable secondary path exists via an alternative mobile subnetwork.

One approach to increase the stability, from the BIS prospective, would be to implement measures, either within the subnetwork or the mobile SNDCF, to dampen the potentially unstable reporting of subnetwork connectivity. A relatively straightforward way of doing this would be to:

a) not issue a Join Event until at least *tbd* seconds after a Leave Event had been issued for the same remote DTE address; and

b) require that under the conditions in a) above that the Join Event would only be issued after the connection has been confirmed to have been available for at least *tbd* seconds.

For example, it could be required that a mobile subnet not issue a Join Event for at least 90 seconds after having issued a Leave Event associated with the same remote BIS. An additional requirement would be that the new connection must have been verified to have been available for at least 60 seconds at the time the Join Event is issued. However care must be taken to not invoke this procedure during a normal ground station handover process where the same air-ground BIS is involved. Also it may be more appropriate to related the required times identified in a) and b) above to the ATSC traffic class supported by the given mobile subnetwork rather than defining fixed values applicable to all mobile subnetwork.

Such a mechanism to constrain the issuance of Join Events could be either incorporated in the mobile subnetwork or in the mobile SNDCF. However, the mechanisms to implement item b) above could be accomplished more efficiently within the mobile subnet where monitoring of link status could be a normal function of the subnetwork (e.g., performed at the data link layer). Addressing this requirement within the mobile SNDCF could result in additional network layer communications traffic across the mobile subnet resulting in a less efficient solution.

It must be noted that the developers of the SARPs for the Mode S and the VDL Mode 3 subnetworks have included provisions that attempt to address the core issues described in this working paper. The effectiveness of these provisions should be considered by ATNP WG2.

It must also be noted that IDRP includes a timer that partially addresses the 'route flapping' problem by advertising non-reachability of an aircraft quickly while the advertisement of aircraft reachability would be delayed. However, over reliance on this IDRP mechanism could result in overall delays in the advertisement of available routes. Placing more burden on the mobile subnetworks themselves to monitor and report connectivity could result in overall improved service availability by allowing the BISs to have more dynamic knowledge of the available routes.

4. RECOMMENDATIONS

The working group is invited to consider the above material and to develop enhancements to Doc 9705 Sub-Volume V to constrain the issuance of Join Events along the lines described in paragraph 3 above.

Specifically it is proposed that Doc 9705 Sub-Volume V be enhanced to include a recommendation that mobile subnetworks provide mechanisms to constraints the issuance of Join Events, along the lines described above or by other suitable means, and that for those mobile subnetworks that do not support this recommendation, an equivalent mechanism would be defined within Sub-Volume V for the mobile SNDCF.