EUROCONTROL

ATNP/WG3/WP/**12-06**.

11 March 1998

AERONAUTICAL TELECOMMUNICATION NETWORK PANEL

WORKING GROUP 3 (APPLICATIONS AND UPPER LAYERS)

Rio de Janeiro, Brazil, 16 - 20 March 1998

CNS/ATM-1 Baseline and Version Control

Prepared by: Tony Kerr

Presented by: Danny Van Roosbroek

SUMMARY

Since the 9th meeting of WG3, changes to the SARPs text produced by the Working Group have been controlled by the CCB process. Despite this, the SARPs have evolved in such a way that backwards compatibility has not in general been achieved, and implementors have had a moving target to aim at. Now that the Version 2.2 SARPs have reached maturity and been published as an ICAO Manual, it is essential that any future changes will either be back-compatible at the protocol level, or that the protocol version is incremented.

The Working Group is invited to approve the recommendations in this paper, and pass them to the CCB for adoption.

1. INTRODUCTION

Since the 9th meeting of WG3, changes to the SARPs text produced by the Working Group have been controlled by the ATNP CCB process. Despite this, the SARPs have evolved in such a way that backwards compatibility has not in general been achieved, and implementors have had a moving target to aim at.

The Working Group is invited to approve the recommendations in this paper, and pass them to the CCB for adoption.

2. BACKGROUND

The SARPs developers have taken great care to incorporate extensibility mechanisms in their specifications to enable back-compatibility to be achieved. These mechanisms include:

a) the judicious use of ASN.1 extensibility markers in data definitions,

b) the encoding of version numbers within the protocols (not to be confused with the version number of the SARPs document. Only Version 1 has been used so far).

c) the use of standard headers to distinguish between applications,

d) version number embodied in the Application Context identifier exchanged by ACSE.

However, no use has been made of these features to date in PDR resolutions.

The result is that, in general, implementations of the post-Phuket SARPs are incapable of interworking with, or even recognising, implementations of the ICAO V2.2 SARPs.

Now that the Version 2.2 SARPs have reached maturity and been published as an ICAO Manual, it is essential that any future changes will either be back-compatible at the protocol level, or that the protocol version is incremented.

If changes are made using the extensibility features, then much of the efficiency of the ASN.1 Packed Encoding Rules will not apply for the extensions. An “old” implementation would simply ignore any extensions present in data received from a “new” implementation. If there are multiple extensions, due to multiple PDR resolutions, then an “old” implementation would ignore any extensions which it did not “know” about.

If a change is required which cannot be accommodated using the extensibility features, then there is no choice but to define a new version of the application protocol. In that case, an “old” implementation will not be capable of interworking with a “new” implementation at all.

Note that if a change is considered safety-critical, then all “old” implementations would be required to implement it. This could be enforced by procedural means (such as grounding aircraft until the avionics software is physically upgraded, then updating the internal software identifier) rather than being embedded in the end-to-end protocol.

3. EXAMPLE - USE OF EXTENSIBILITY

Consider a fictitious example. If a data type AnyMessage in some application were extended so that it changed from:

```
AnyMessage ::= ENUMERATED {
      messageType0                (0),
      messageType1                (1),
      ... }
```

to:

```
AnyMessage ::= ENUMERATED {
      messageType0                  (0),
      messageType1                  (1),
      messageType2                  (2),
      ... }
```

Then the one additional value would mean that the PER encoding would occupy 4 bits rather than 3 (including the extensions bit). A decoder conforming to the old application protocol would thus be one bit out of alignment when decoding this and all subsequent fields in the PER-encoded bitstream. Thus no interoperability is possible.

If instead, the extra value were added after the extension marker, as follows:

```
AnyMessage ::= ENUMERATED {
      messageType0                  (0),
      messageType1                  (1),
      ...,
      messageType2                  (2)
      }
```

then the old application would still not be able to handle an instance of messageType2, but it would be capable of decoding the PER-encoded bitstream and using the application in its old mode. Thus interoperability is achieved between the old and new versions of the application.

4. EXAMPLE - TES IMPLEMENTATION

The Eurocontrol TES software (which is described in a separate Working Paper) contains software implementations of the ADS, CPDLC, CM and ULCS SARPs. It is currently based on the ICAO V1.1 (ex-Phuket) version of the SARPs - the version which was placed under CCB control.

Since that date, a number of PDRs have been raised, which the WG3 SMEs have been very successful in resolving. The statistics, for the SARPs which affect TES, are:

SARPs	Total Number of Resolved PDRs in ICAO V2.2	PDRs which affect “bits on the wire” interoperability
ULCS	6	0
CM	2	1
ADS	11	1
CPDLC	24	13

Not all of the PDR resolutions affect the "bits-on-wire" interoperability. To achieve interoperability with other ICAO V2.2 implementations, only the PDRs listed below need to be implemented in TES. No changes are required to ADS, and only a single small change to CM. However CPDLC has major ASN.1 changes. In principle, one would just need to update the ASN.1 file and re-input to the ASN.1 compiler to achieve the required level of bits-on-wire compliance. However, there are also major impacts on the higher-level interface provided by the “Formatting and Unformatting Functions”.

PDRs affecting SARPs V2.2 bits-on-wire are:

97080005	ADS Invalid ASN.1 (missing comma)
97100006	CM Exception Handling Correction
97060009	CPDLC Facility Designation
97060011	CPDLC LatLong
97080010	CPDLC Modification Unit Name Definition
97080011	CPDLC Proposed Change to ASN.1
97100008	CPDLC Position Report Format Change in PANSRAC
97100010	CPDLC Incorrect Range for LevelFeet Parameter
97100011	CPDLC Reduction on Potential Message Size
97100013	CPDLC Additional Traffic Type
97100016	CPDLC/AIDC VHFFrequency/VHFFrequencyChannel
97100019	CPDLC ASN.1 Definition of Facility Function
97100026	CPDLC Exception Handling Correction
97100037	CPDLC reserved message element
97100039	CPDLC - Route Clearance

5. RECOMMENDATIONS

It is recommended that the CCB should be advised to implement the following provisions:

1. Define a Baseline consisting of all PDRs closed in the ICAO V2.2 SARPs.

Then for any PDRs which are still open, or which are subsequently submitted:

2. Use best endeavours to find a solution that will not affect interoperability with the Baseline.
3. If such changes are unavoidable, then ensure that the extensibility features inherent in the data definitions are actually utilised (e.g. insert new field AFTER the ASN.1 extensibility marker).
4. If a major change is required which cannot be accommodated using built-in extensibility features, then the protocol version identifier will have to be incremented (this has no relation with the SARPs document version number). In such cases, interoperability with the Baseline application version will not be possible. This should be a rare event.
5. Within each category, distinguish changes that are safety-critical from those that are enhancements or extensions to current application protocols. For the safety-critical cases, all operational implementations will be required to implement the changes, as is the case for current systems